SUSPER

Final summary report of SUSPER (Sustainable Development of Peri-Urban Agriculture in South-East Asia)

Rapport final de SUSPER

Edited by
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Avec synthèses en français

April 2007

SUSPER

Sustainable Development of Peri-urban Agriculture in South-East Asia Project
(Cambodia, Lao PDR, Vietnam)

Moustier P., Final summary report of SUSPER
(Sustainable Development of Peri-Urban Agriculture in South-East Asia). Hanoi, The Gioi edition, 152 p.

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Acknowledgements

The regional Project on Sustainable Peri-urban Agriculture in Southeast Asia started in 2002 and was supported by a grant from the French Ministry of Foreign Affairs. The project proposal was initiated by Mr. Bruno Vindel and Dr. Paule Moustier. In the Ministry, the project was supervised by Mr. Bruno Vindel, from 2002 to 2004; and then by Mrs. Marie-Cécile Thirion from 2005 to 2006. In the French Embassy in Hanoi, the project was monitored by the following officials in charge of cooperation in the area of agriculture: Mr. Serge Snrech, then Mrs. Hélène Ly-Batallan (French Embassy, Hanoi); Mr. Dominique Dordain and Mr. Richard Mouthuy (French Embassy, Phnom Penh), and Mr. Jean-Marc Bouvard (advisor to the Ministry of Agriculture, Forestry and Fisheries); Mr. André Grasso and then Mr Gilles Lainé (French Embassy, Vientiane).

The project was jointly coordinated by AVRDC and CIRAD. In AVRDC, it was supervised by Dr. Lowell Black, then by Dr. Mubarik Ali. Dr. Hubert de Bon coordinated the project from the CIRAD side. A regional coordinator based in Hanoi was appointed by the French Ministry of Foreign Affairs, namely Dr. Hubert de Bon from 2002 to 2004, and Mr. Boun-Tieng Ly from 2004 to 2006. The national coordinators of the project were Dr. Tran Van Lai for Vietnam (Dr. Le Thanh Hung being the the site coordinator in Ho Chi Minh City); Mr. Phat Leng for Phnom Penh; Mr. Kham Sanatem and then Mr. Bounchanh Kombounyasith for Vientiane.

The project received scientific guidance for its different components: Dr. Mubarik Ali (AVRDC) for Component 1 on Production Systems, Dr. Paule Moustier (CIRAD) for Component 2 on Market Development, and Dr. Lowell Black, then Dr. Manuel Palada (AVRDC) for Component 3 on Technical Innovations. Other scientists involved are listed below: From CIRAD: Dr. Frédéric Borne (G.I.S.), Dr. Isabelle Vagneron (marketing), Dr. Pierre-Marie Bosc (farmers' organisations), Dr. Philippe Cacot (aquaculture), Dr. Jean-François Lecoq (stakeholders' workshops), Dr. Vincent Porphyre (livestock), Dr. Remi Kahane and Dr. Jacky Ganry (general guidance on project orientations). From AVRDC: Dr. Talekar (insect management), Mr Su-Tien Ji and Mr Tien-Cheng Wang (shelters); Dr. Raj Lada (vegetable production); and Dr. Thomas Kalb (project communication).

A steering committee met every year to review the project activities of the past year and the work plan of the next year. It was chaired by the General Director of AVRDC, Dr. Samson Tsou, then Dr. Thomas Lumpkin. The members of the steering committee have been: Mr. Mak Soen, MAFF, Cambodia; Dr. Nuth Sakhan, MAFF Cambodia (sadly deceased in 2004), Dr. Pham Minh Tri, Samtestcen, Vietnam; Mrs. Mai Thi Phuong Anh, Department of Agriculture and Rural Development; Dr. Tran Khac Thi, Deputy Director of RIFAV*, Vietnam; Mr. Hoang Ngoc Bao, MARD, Vietnam; Dr. Bounliep Chountavong, MAF, Laos; Mr. Vilaysouk Khennavong, MAF, Laos; Mr. Khamphanh Thommavong, Vientiane municipality; Mr. Sombath Vonglatsamee, MAF, Laos; the latter two being replaced by Mr. Khampilay Chounlamountry, MAF, Laos and Dr. Lasay Nuanthasing, MAF, Laos in the third steering committee; Mr. Serge Snrech (French Embassy, Hanoi) and Mr. Olivier Gilard (Agence Française du Développement, Hanoi) in the first steering committee; Mrs. Lise Pichon and Mr. Yannick Balerin (Agence Française du Développement, Phnom Penh) in the second steering committee; Mrs. Marie-Cécile Thirion (French ministry of foreign affairs) in the third steering committee; Mr. Prun Mao (Chicken Farmer Association, Siem Reap) in the first steering committee.

The project benefited from the invaluable contributions of highly dynamic and professional project assistants. Special mention is due to Mrs. Nguyen Thi Thu Nhai, who dealt with the complex financial management of the project, as well as a number of organisational tasks. Ms. Kim Anh worked from 2004 to 2006 in the project as communication assistant and set up the website with the support of Mr. Boun-Tieng Ly. In Taiwan, Ms. Olivia Lang also played a highly valuable role in the financial and logistical management of the project. In Montpellier, Nathalie Seguret played a similar efficient role on the CIRAD side.

* Now FAVRI (Fruit and Vegetable Research Institute).

In late 2006, the project was extended until July 31, 2007, but for various administrative reasons the contract for the regional coordinator was not extended (subsequently Mr. Ly was contracted by CIRAD from May to the end of July 2007 in order to complete some project reports). Dr. Paule MoustierI was then asked by the senior management of AVRDC and CIRAD-FLHOR to organise the final project seminar and the report herewith containing the edited summaries of the main project reports and syntheses of the main results. Mr. Christian Langlais, CIRAD, provided a first draft compilation of the report summaries. The role of David Smith and David Rorke, English editors, for the present document is acknowledged. Dr. Hubert de Bon (CIRAD) and Dr. Manuel Palada (AVRDC) made valuable comments. The English editing and printing of the report was funded by MALICA, a consortium of food marketing research groups including CIRAD, VAAS and IPSARD.

SUSPER Main Activities and Results

Paule MOUSTIER, CIRAD.

The regional project on Sustainable Development of Peri-urban Agriculture in Southeast Asia (SUSPER) was conducted from 2002 to 2006 with funding provided by the French Ministry of Foreign Affairs. It was supervised jointly by AVRDC and CIRAD. The purpose of the project was to raise the capacity of the public and private stakeholders involved in making peri-urban agriculture more sustainable and profitable, thus making a greater contribution to food security. Regional cooperation on joint interest for topics related to peri-urban agriculture was also reinforced. The project worked in four Southeast-Asian cities: Hanoi, Ho Chi Minh City, Phnom Penh and Vientiane.

In the project, peri-urban agriculture is defined as agriculture located inside a city (urban or intra-urban agriculture) and in its close periphery (peri-urban agriculture in the strict sense of the term), producing outputs which are consumed in the city and using land that may be used for agricultural as well as non-agricultural uses including construction. This sector mainly covers perishable products (vegetables and meat).

The specific objectives of the project are detailed below:

1) Understand the specific constraints and advantages of peri-urban farmers in relation to the proximity of the urban environment and market

This is the specific objective of Component 1, with two major types of activities: (a) analysis of production systems (in all cities), based on the gathering of secondary data and conducting of quantitative surveys (supervised by AVRDC); and (b) designing of geographical information systems (in Hanoi and Phnom Penh, supervised by CIRAD).

2) Identify and target new market opportunities for vegetable and fish farmers (Component 2, supervised by CIRAD).

This information was obtained by a combination of qualitative and quantitative surveys; stakeholder meetings (attended by farmers, traders, extension agents and consumers); communication with consumers and farmers through various media (television, newspapers, etc.); quick tests for chemical residues on vegetables and in fish; improved communication between relevant administrative bodies and selected farmer groups for quality control and certification.

3) Test and disseminate innovations to bring peri-urban agriculture more in line with the market demand, making it more profitable and sustainable (Component 3)

Three major innovations were tested during the project:

- Off-season tomato production (using grafted tomato and rain shelters) in Hanoi, Phnom Penh and Vientiane (under AVRDC supervision)
- Safe leafy vegetable production under low-tunnel nets in Hanoi, Phnom Penh and Vientiane (under AVRDC supervision)
- Aquaculture in floating cages in Ho Chi Minh City and Phnom Penh (under CIRAD supervision). Frog production was also successfully tested as a diversification option in the two cities

The dissemination of these innovations to farmers was based on existing farmer organisations and the development of communication between farmers, extension agents and researchers.

The main project partners are indicated in Table 1.

Table 1- Main SUSPER Partners

	Hanoi	Ho Chi Minh City	Phnom Penh	Vientiane
Local coordinator	Research Institute on Fruits and Vegetables (RIFAV)	University of Agriculture and Forestry (Nong Lam University)	Department of Agro-industry, Ministry of Agriculture, Forestry and Fisheries	Department of Agriculture, Ministry of Agriculture and Forestry
Other partners	Hanoi People's Committee; Ministry of Agriculture and Rural Development; Hanoi Seed Company		NGOs (Srer Khmer, AGRISUD); Bureau of Urban Affairs of Phnom Penh Municipality; Credit Department, Ministry of Rural Development; Agricultural Marketing Office, Department of Planning, Ministry of Agriculture and Forestry and Fisheries	

The main results of the project have are summarised as follows:

The project has definitely increased the capacity of researchers and officers in the Ministries of Agriculture of the three countries in the areas of market analysis, farm economic analysis, geographical information systems, technical innovations and intra-chain dialogue. This was achieved by a number of training sessions (see Table 2), workshops and meetings (see Table 3), and also by the preparation of around 90 reports by joint international and national teams which are outlined in this document.

Table 2- Training Activities in the SUSPER Project

TOPIC	NATURE	PLACE	LENGTH	NUMBER AND NATURE OF PARTICIPANTS	TRAINING MATERIAL
Component 1					
Review of Hanoi agriculture	Visit to AVRDC, support for data analysis and reporting	Tainan	2 months (28/10–01/11/02)	2 Hanoi project associates (1 RIFAV and 1 Hanoi People's Committee, Dept of Agriculture)	
Farm economic analysis	Visit to AVRDC, support for data analysis and reporting	Tainan	2 months (09–10/04)	1 Hanoi project associate (RIFAV)	
Production system analysis	Visit to SUSPER-FAVRI, support for data analysis and reporting	Hanoi, FAVRI	5 days	2 project associates (1 from Laos, 1 from Cambodia)	
Geographical information systems	Visit, training in software	CVTGeo, Hanoi	2 months (06–07/03)	2 Hanoi project associates (1 RIFAV, 1 Department of Agriculture, Hanoi People's Committee)	
	Visit, training in software	AIT, Bangkok	10 days (11–22/08/03)		
			5 days (9–13/05/04)	2 Hanoi project associates (1 RIFAV, 1 Department of Agriculture, Hanoi People's Committee), 2 Phnom Penh project associates (Bureau of Urban Affairs)	

Component 2					
Market analysis	Workshop	Hanoi, RIFAV	6 days (25/02/02–05/03/02)	21 (researchers and officers) with two project associates/city	All presentations to participants
Statistical analysis (SPSS)	Workshop	Hanoi, RIFAV	4 days (28/10–01/11/02)	18 (researchers and officials) with two project associates/city	Handbook
Negotiation tools in animal commodity chains	Workshop	Hanoi, VASI	6 days (28/07–01/08/02)	2 Vientiane project associates, MAF Department of Agriculture	
Consumption analysis	Visit to AVRDC, support for data analysis and reporting	Taiwan-Kaoshiung	4 months (08/08–07/10/04)	2 Hanoi project associates (1 RIFAV, 1 GSO)	
Market information systems	Workshop	Hanoi, FAVRI	5 days (9/05/05–13/05/05)	20 (researchers and officials) with two project associates/city	Proceedings
Market analysis	Visit to SUSPER-FAVRI, support for data analysis and reporting	Hanoi, FAVRI	15 days (9–13/05/04)	5 project associates (2 from Laos, 3 from Cambodia)	
Quick tests of pesticide residues	Workshop, demonstration	Vientiane, Plant Protection Center of MAFF	5 days (08–12/11/04)	10 staff of MAFF	
Component 3					
General vegetable production	Study tour	Taiwan-Kaoshiung	15 days (02–17/10/02)	3 project associates (1 RIFAV Hanoi, 1 Phnom Penh MAFF, 1 Vientiane MAF)	Trip report
Tomato grafting and plant protection	Visits, demonstrations	Taiwan-Kaoshiung	13 days (17/04–30/05/02)	6 project associates (2 RIFAV Hanoi, 2 Phnom Penh MAFF, 2 Vientiane MAF)	Training reports
Tomato production under shelter, tomato grafting	Workshop, demonstration	Hanoi, 4 project sites	4 days (5–9/05/03), 1 day/site	100 farmers (25/site)	Leaflet, CD, television programme
	Demonstration	Hanoi, RIFAV	25/06/03	Extension staff (7) and farmers from 5 districts (25 including 5 heads of cooperatives)	
	Demonstration	Hanoi, Hanoi Seed Company	2 months 01/07–31/08/05)	10 staff of Hanoi Seed Company trained by one researcher from Hanoi Agricultural University (plus one-day training at RIFAV)	
	Workshop, demonstration	Phnom Penh, Dey Eth	10 days (20–30/10/03)	23 farmers	
	2 Workshops	Vientiane		19 trainers 29 farmers	
Low tunnel net leafy vegetable production	Demonstration	Hanoi, RIFAV	25/06/03	Extension staff (7) and farmers from 5 districts (25 including 5 heads of cooperatives)	CD, television programme, leaflet
	Workshop, demonstration	Phnom Penh, Dey Eth	10 days	23 farmers	

			(20–30/10/03)		
	Fieldtrip	Phnom Penh, Dey Eth	1 day (01/06)	57 farmers	
Tilapia intensive production in nylon cages	Workshop, demonstration	Ho Chi Minh City, Da Phuoc and Phong Phu communes	2 days (06 and 16/07/04)	42 farmers (06/07/04, Da Phuoc) and 45 farmers (26/07/04, Binh Chanh)	Leaflet
Tilapia and frog production	Study tour	Ho Chi Minh City	5 days (15–19/11/04)	10 Phnom Penh farmers and 10 Phnom Penh officers from Fisheries Department	Manual on frog production
Frog production	Workshop	Ho Chi Minh City, Phuoc Vinh An district	1 day (09/06/05)	55 farmers	

Table 3- List of Workshops and Meetings Organized by SUSPER (apart from training workshops)

STEERING COMMITTEE MEETINGS					
Location	Date	Number of participants			
Hanoi	03–04/10/01	22			
Phnom Penh	16-22/01/03	39			
Vientiane	15–17/12/04				
Other meetings on project results					
Meeting on vegetable market opportunities in Phnom Penh					
Phnom Penh, MAFF	15/02/05	27 including 13 from MAFF, 3 from municipalities, 5 from NGOs, 5 from French Cooperation, 1 from university			
Final seminar					
Hanoi, RIFAV (plus one day field trip in HCMC)	27–29/06/06	57 including 8 from Cambodia, 2 from Laos, 3 from Taiwan, 2 from France and 42 from Vietnam (37 from Hanoi, 5 from Ho Chi Minh city). The seminar was attended by the head of the Vietnam Academy of Agricultural Science. Participants also included 3 journalists and four heads of vegetable cooperatives.			
Intra-chain stakeholders' workshops (presentation and discussion on vegetable marketing opportunities)					
Location	Date	Number of producers	Number of traders	Number of extension agents and inputs dealers, and others	Total
Hanoi					
Market seasonality					
RIFAV, with participants from the 4 project sites (focus on seasonality)	18/04/03	7 (1 co-op director and 1 producer / project site invited)	2 wholesalers (1 Den Lu, 1 Long Bien)	7 extension agents or inputs sellers, from the various sites 27 officers and research agents	43
Dong Du	18/06/03	20		3 researchers	23
Vo Cuong	16/06/03	18	2 (collectors)	2 inputs sellers, 3 researchers	25
Tien Duong	06/06/03	21		3 researchers	24
Tien Phong	29/05/03	16	4	3 researchers	23
Quality					
RIFAV	17/06/03	6 co-op directors	4 collectors, 3 retailers	2 representatives of consumer association 3 journalists 3 officers 10 researchers	31
Dong Du	10/10/03	68 including 2	1 collector, 2	11 research and	82

		co-op directors	retailers	extension agents	
Phnom Penh					
Kien Svay	29/05/03	11	22 (6 collectors, 6 wholesalers, 10 retailers)	3	40
Vientiane					
Department of Plant Protection	08/11/02	3	6	6	15

Regional cooperation was enhanced in the following areas:

- Market analysis: This was achieved through the three regional training workshops in Hanoi (one on market analysis, one on statistical analysis, one on market information systems—see Table 2), where experience in vegetable and fish market development was exchanged among the three countries; in particular, the knowledge of regional vegetable trade between Vietnam-Cambodia was enhanced by the participation of teams from the two countries;
- Tests of chemical residues: The expertise of FAVRI on quick test pesticide analysis was transferred in Vientiane. Tests on heavy metal content were performed in the Nong Lam University for fish produced around Ho Chi Minh City, as well as water convolvulus produced in Phnom Penh;
- Aquaculture: Skills in nylon net cage use and frog production were transferred from Ho Chi Minh City to Phnom Penh.

Peri-urban agriculture was characterised in the three countries, with a special focus on vegetable and fish production systems. The surveys confirmed that peri-urban agriculture displays specific features relative to rural agriculture, such as farms that are located near the city centre;,small land size; diversified sources of income in the household (although agriculture provides the main source of income); generalised use of chemical inputs; but at the same time access to various sources of training on IPM. The main constraints mentioned by farmers relate to marketing problems and (as regards vegetables) flooding in the rainy season (plus water shortages in the dry season as regards Phnom Penh). The prevalence of marketing problems may appear surprising given the proximity of urban markets. But it is quite typical of perishable and seasonal products.

Marketing problems have been dealt with by a thorough analysis of the market opportunities still untapped by peri-urban farmers. This was based on various consumer and trader surveys. Two major strategies have been identified for vegetable farmers to gain higher market shares: the provision of off-season vegetables and the provision of vegetables that can be identified as safe by consumers. As regards to off-season vegetables, market surveys have shown that in the three countries prices may be twice as high in the period extending from May to November relative to other months of the year for tomatoes as well as for some types of cabbage. During these periods, vegetables are imported from neighbouring countries (China for Vietnam, Thailand for Laos, Vietnam for Cambodia). Imports subside as soon as local production increases. As regards to the demand for safe vegetables, farmers who are able to label their vegetables as safe and develop direct marketing with consumers or specific buyers, e.g., school cafeterias, are able to earn higher incomes and expand their business. Yet this long-term ability is jeopardised by the lack of consumer trust in the present system of certification and low traceability in the vegetable chains. In Laos and Cambodia, vegetable safety is also a key criterion in the choice of vegetables by traders, as they declare that local products are preferred by consumers who assume they are safer than imported products (which is indeed suggested by quick tests of pesticide residues conducted by RIFAV). Yet in Laos and Cambodia traceability and labelling of vegetables are lacking, while these features could be a way for farmers to better promote their products.

As regards to fish, consumers in Ho Chi Minh City are still mostly unaware of the safety risks pertaining to fish grown in polluted water, while the analyses conducted by Nong Lam University showed an excess of heavy metals (especially arsenic) in fish grown in water polluted by adjacent factories (but not in another village where water is also polluted but where the factories are located

further away). Among fish supplied by peri-urban areas, red tilapia is the species with the highest market potential.

The information on vegetable market opportunities was presented to a panel of farmers, traders, consumers, researchers and extension agents during various stakeholder workshops held in the three countries. These stakeholder workshops also provided an opportunity to assess the needs for regular market information on the part of farmers, who expressed their demand for daily price information disseminated either by the way of television (in Hanoi) or by radio (in Phnom Penh and Vientiane).

In the area of the production and market assessment, technical and institutional solutions were tested and evaluated for peri-urban agriculture to fit better with market demand and thereby generate higher income for farmers. The findings regarding the produce market supply channels made it possible to guide the selection of production zones for the other project components, given their importance and continuity in supplying the city, their location far from sources of pollution, and also their being taken into consideration by the departments of agriculture of the city or province in terms of development plans. These findings also make available quantified data on the role of peri-urban zones in terms of supplying city dwellers with fresh produce, especially leafy vegetables and some species of fish. These findings are of particular interest to persons in charge of urban planning in Hanoi and Phnom Penh.

The most successful technical solutions tested are listed below:

- Off-season tomato production through grafting in Hanoi. Tomato plants grafted on eggplant rootstocks were resistant to bacterial wilt and suffered less damage from floods. This enables transplanting of tomatoes in August and harvesting from October to December when prices were twice as high as in the dry season and when the tomato supply was partly imported from China.

Picture 1 - Practical training on grafting tomato in RIFAV (@ H. de Bon)

Tomato seedlings have been provided to farmers by RIFAV or by the Hanoi Seed Company, a semi-private company. The staff of Hanoi Seed Company were successfully trained by SUSPER Project to produce grafted tomato seedlings. The sale price varied from 200 to 500 VND (0.01 to 0.05 USD) per seedling depending on the quantities purchased.

- Aquaculture in floating nylon cages in Ho Chi Minh City and Phnom Penh.

Pictures 2 - (Traditional wooden cage) 2 and 3 (nylon cages) - @ Boun-Tieng Ly

As regards to institutional solutions, the most successful ones were:

- Market information and consultation systems (MICS) on vegetable market seasonality in Hanoi, Vientiane and Phnom Penh
- Labelling and certification of safe vegetables in Hanoi, Dong Du Cooperative

Picture 4 - Tomatoes and guava packaged and labelled with cooperative contact

@ P. Moustier

Picture 5 - The shop of Dong Du cooperative in Gia Lam market

Some indicators of impact are presented in Table 4 (see also Table 5 the summary of project achievements). The number of direct beneficiaries is still small, but the project tested successful technical and institutional solutions that can now be used as models and disseminated by relevant extension bodies.

The following activities have proven difficult to implement, with little or moderate success:

1) Tomato production under plastic shelters
The major constraint was that the plastic shelters are damaged by heavy storms.

2) Off-season tomato production in Laos and Cambodia
Although experiments on-station have yielded promising results and training programs were organised for farmers, monitoring of work with farmers in the field suffered delays and logistical

problems, including the difficulty in identifying seed companies with which to collaborate in supplying farmers with grafted seedlings.

3) *Market information systems in Laos and Cambodia*

Activities did not move ahead as planned due to implementation delays in the field. In particular, market bulletins were prepared but were not disseminated to farmers.

4) *Geographical information systems*

The work was insufficiently linked with urban planners in Hanoi. There are various reasons for this, including difficulties in getting the Hanoi People's Committee interested in the topic (despite the involvement of staff from the Department of Agriculture of the Hanoi People's Committee in the project). On the other hand, in Phnom Penh, the training on GIS and the transfer of SUSPER expertise on peri-urban agriculture have contributed to the design of the city master plan. It is also noteworthy that SEARUSYN, a project funded by the European Union on the specific topic of integration of agriculture in urban planning in Hanoi, achieved some interesting results, with improved dialogue between the authorities of Gia Lam district, Dong Du commune, and the Hanoi People's Committee on the integration of agriculture in urban planning (http://www.searusyn.org).

5) *Farmer organisations*

Component 2 activities on market development included some work on farmer organisations, i.e. setting up market information and consultation systems, support to farmers' organisations for joint marketing, labelling and certification in Dong Du, Hanoi. Initially, it was planned that the project would help farmers to join in groups to benefit from joint extension and input services relative to the technical innovations. Yet the experiments and the demonstration of the efficiency of the innovations took longer than planned so that the actual time available for the extension work with farmers was limited to the last year of the project. Other projects involved in extension, including the DIALOGS project in Vietnam (funded by the European Union and coordinated by GRET), had their own limitations in terms of human resources which prevented the cooperative arrangements initially contemplated. Fortunately, the positive linkages of the SUSPER project with the Hanoi Seed Company in Vietnam and the Srer Khmer NGO in Cambodia, along with the actual existence of farmers' groups prior to the project, facilitated the dissemination of innovations. In Vietnam, cooperatives still perform a role of interface between farmers and extension services. In some of them farmers are organised into "safe vegetable groups" where they receive IPM training given by NGOs, such as ADDA and where contacts with customers are organised by the group leaders or heads of cooperatives. In Cambodia, similar groups have been organised by Srer Khmer.

Some follow-up actions are presented below:

- In Vietnam, ICARD will continue the daily price information system (with support from the ADB);

- Produce labeling, control and certification continued in 2006 and contacts were promoted between farmers' groups and buyers, especially in Hoai Duc district, Ha Tay province, supported by Ha Tay Province and MALICA (Markets and Agriculture Linkages for Cities in Asia), a consortium between CIRAD, VAAS [Vietnam Academy of Agriculture Science] and IPSARD [Institute on Policy and Strategies on Agriculture and Rural Development]), in cooperation with the ADB/DFID project "Making Markets Work Better for the Poor". Similar work will be undertaken in rural areas of Vietnam and Laos in the context of a project supported by IFAD, "linking rural farmers with supermarkets and other quality chains".

AVRDC through its regional center in Thailand (ARC – Asian Regional Center) has obtained funding from IFAD supporting the project titled "Safe and Off-Season Vegetable Production in Ha Tinh and Tra Vinh Provinces of Vietnam". The focus of the project is on development of more efficient markets

for the poor in these two districts. It aims to contribute to sustainable improvement of income of poor people from rural areas of Vietnam by developing and testing innovative opportunities in safer and off-season vegetable production than can be replicated and up-scaled by the government. This project will capitalize on the results and achievements of the SUSPER Project in Vietnam.

In all three countries, the emphasis that the project placed on transferring research and intervention methods through workshops and publications is something that will ensure the sustainability of most of the undertakings, although funding must be found in order to increase the scale.

The rest of the document gathers the summaries of the main reports written and disseminated during the project. They are generally available on the project website (http://www.avrdc.org/susper) and in printed form in FAVRI or CIRAD, Hanoi, as well as AVRDC headquarters.

Table 4- Impact Indicators of the SUSPER Project's Main Development Activities

	Number of users	Increase in output	Increase in income	Other indicators of success	Sustainability of action
Tomato grafting (see Ha, 2006, infra, 3.1.6)[1]	Hanoi, Tien Duong: 20; Vinh Phuc, Tien Phong: 1 Hanoi, 21 contact farmers of Hanoi Seed Company (Tay Ho, Gia Lam, Long Bien, Soc Son, Tu Liem districts) Total sales by RIFAV of grafted seedlings in 2005:12,000[2] and 2006: 10,000 (equivalent to 3,600 m²), including 3,000 in Tien Duong Total sales/gifts by HSC in 2005: 50,000 Total sales/gifts by HSC in 2006: 10,000 (including 3,000 in Tien Duong)	Tien Duong: 18.6 t/ha compared to 14.1 t/ha (31% increase) for 7 farmers or 0t/ha for 6 farmers	Tien Duong: $50 compared to 0 or $17 for the summer tomato cycle, average area of 368 m^2 (x3) $1,150/ha compared to 0 or $687/ha	12/20 farmers interviewed in Tien Duong want to continue The three Tien Duong farmers and cooperative head present at SUSPER final seminar praised the benefits of the technology. Sales of seedlings by RIFAV in various provinces (Hanoi, Hatay, Bac Giang, Bac Ninh, Hai Phong)	Technology transferred to Hanoi Seed Company which sells the seedlings to farmers But economic and technical monitoring by farmers would be useful
Leafy vegetables under low tunnel nets (Hanoi: see Ha, 2006, infra, 3.1.7[3])	Hanoi: 3 in Tien Duong, Vinh Phuc: 1 in Tien Phong Evaluation of leafy vegetables under net also for 26 Hanoi farmers in Van Noi	12.3 t/ha compared to 9.4 t/ha (no net, low pesticide use) or 11t/ha (no net, high pesticide use)	$32 compared to $19 for one cycle of leafy vegetables, average of 280 m^2 (70% more)	Nets still in use in 2007	High cost of shelters ($1,440/ha, or $43 for 300 m² - for 8 crop cycles; note: $117 for 300 m² for Van Noi shelters combining net and plastic shelters) should be supported by credit system
(Phnom Penh: see Centmill,	Phnom Penh: 18 farmers (Kien Svay and	8 to 25% increase	10 (Chinese kale) to		Lower costs when low net tunnel is

[1] The comparison is between 20 farmers using grafted tomato and 11 farmers using non grafted tomato in Tien duong commune (Dong Anh district).

[2] In 2005 SUSPER covered 400 VND out of 500 VND of the cost of seedlings, so the farmer only paid 100 VND, while in 2006 farmers had to pay 350 VND for seedlings sold by RIFAV and 500 VND for seedlings sold by the Hanoi Seed Company.

[3] The comparison is between 30 farmers in Hanoi using low tunnel nets and 9 farmers not using low tunnel nets (3 in Ha Tay, 3 in Vinh Phuc, 3 in Hanoi).

2005, infra, 3.1.8)	Saang districts)	according to species and season	120 $ (sprin g onion) for 300 m^2 compared to negative returns		used. No pesticide spray without cover is even more profitable and should be promoted
Nylon net cages for tilapia (see Hung and al, infra, 3.2.2)	Increase from 8 to 92 tilapia producers around HCMC	Production multiplied by 18.2 (from 600 to 10,930 tons) between 2002 and 2006	Total net income of new farmers: 1.24 million dollars (i.e. 13,000 $/far mer)	Dissemination in peri-urban areas as well as Mekong Delta	Local material, cheaper to build than former cages. Spreading by imitation Yet environmental risks need to be monitored

Vegetable MICS Hanoi (see An and al, infra, 2.11)	100,000 vegetable farmers[4]	Mentioned for 80% of users (through higher prices) but not quantified	The three Tien Duong farmers and cooperative head attending SUSPER final seminar claimed the benefits of the market information.	Low-cost system (based on contact traders): $6,500 10 vegetables Now system is managed by MARD-ICARD.
Vegetable MICS Phnom Penh (workshop held on 29/05/03) (see An and al, infra, 2.11)	11 farmers, Kien Svay 22 traders		Workshop evaluation: All participants found market information and interactions with traders useful	
Labelling/certificati on Dong Du Hanoi (see Moustier, infra, summary C2)	70 farmers	By 30% for cooperative stores (around 1,000 $ increase per year)	Contract in 2003 with herb exporter ($3,000 return)	Shared cost for certification: 60% by municipality, 20% by cooperative, 25% by SUSPER

[4] This was by considering a total of around 150,000 vegetable farmers in Hanoi municipality and the surrounding province, based on the total cultivated vegetable area (7,570 hectares – see Phuong Anh and al, 2004) and the average vegetable area (500 m^2 per farm – see introduction to Component 1, infra). The impact survey of MICS showed that 75 percent of vegetable farmers listen to vegetable prices on television, both on project sites and outside project sites (An and Moustier, 2006, infra).

Table 5- Summary of the Main SUSPER Achievements in Relation to Expectations

Planned activity	Achievement
Production system and geographical analysis	Done in the 4 cities Focused on vegetables or fish GIS in Hanoi and PP Partial economic evaluation
Market opportunities identification and monitoring	Done in the 4 cities Permanent monitoring in Hanoi
Test of innovations	Done in the 4 cities
Dissemination of innovations to farmers	Done at varying levels according to cities
Promotion of stakeholders' organisations and services	Mostly for marketing in Hanoi, PP and Vientiane Promotion of private seedling supply in Hanoi
Capacity building	➢ Done in the 4 cities for our partner institutes (research institutes, university, Ministry of Agriculture, Srer Khmer NGO in Cambodia): training, workshops ➢ Training of farmers ➢ Link with urban planners through collaboration with other projects (SEARUSYN/Wageningen and Hanoi Agricultural University; French-funded urban planning project in Phnom Penh
Regional cooperation	Main areas: ➢ Aquaculture (Southern Vietnam and Cambodia) ➢ Market information systems (3 countries) ➢ Pesticide residue analysis (Northern Vietnam, Cambodia, Laos) Exchange of information on the other topics through regional trainings and workshops, exchange of documents

Principales activités et résultats du projet SUSPER

Paule MOUSTIER, CIRAD

Le projet régional sur le développement durable de l'agriculture périurbaine en Asie du Sud-Est (SUSPER) a été mené de 2002 à 2006 grâce à un financement du ministère français des Affaires étrangères. Il a été placé sous la supervision conjointe de l'AVRDC et du CIRAD. Le projet vise à accroître les compétences des acteurs publics et privés pour rendre l'agriculture périurbaine plus durable et plus rentable, contribuant ainsi à la sécurité alimentaire. La coopération régionale dans des domaines d'intérêt commun liés à l'agriculture périurbaine a également été renforcée. Le projet a concerné quatre villes du Sud-Est asiatique: Hanoi, Ho Chi Minh Ville, Phnom Penh et Ventiane.

Pour ce projet, le terme « agriculture périurbaine » désigne l'agriculture située dans la ville (agriculture urbaine ou intra-urbaine) et dans sa périphérie immédiate (agriculture périurbaine au sens strict), sur des terrains qui peuvent être utilisés à des fins agricoles ou non agricoles, y compris pour la construction, et dont les produits sont consommés en ville. Le secteur concerne principalement les produits périssables (légumes et viande).

Les objectifs spécifiques de ce projet sont les suivants :

1) Comprendre les contraintes spécifiques auxquelles sont soumis les agriculteurs périurbains du fait de la proximité de l'environnement urbain et du marché, ainsi que les avantages inhérents à leur situation

C'est l'objectif spécifique de la composante 1, qui comporte deux grands types d'activités : a) analyse des systèmes de production (dans toutes les villes) à partir de la collecte de données secondaires et la mise en œuvre d'enquêtes quantitatives (supervision par l'AVRDC) ; b) mise en place de systèmes d'information géographique (à Hanoi et à Phnom Penh, supervision par le CIRAD).

2) Identifier et cibler de nouveaux débouchés pour les producteurs de légumes et les pisciculteurs (composante 2, supervisée par le CIRAD)

Les informations ont été obtenues grâce à une combinaison d'enquêtes qualitatives et quantitatives, l'organisation de réunions avec les parties concernées (auxquelles ont assisté des agriculteurs, des commerçants, des conseillers agricoles et des consommateurs), la communication avec les consommateurs et les agriculteurs par le biais de différents médias (télévision, journaux, etc.), des tests rapides sur la présence de résidus chimiques dans les légumes et les poissons et l'amélioration de la communication entre les administrations concernées et des groupes d'agriculteurs sélectionnés sur les questions de contrôle de la qualité et de certification.

3) Tester et diffuser les innovations susceptibles de rendre l'agriculture périurbaine plus en phase avec la demande du marché, et la rendant plus rentable et plus durable (composante 3)

Trois innovations principales ont été testées pendant le projet :

- la production de tomates de contre-saison (grâce à des tomates greffées et le recours à des abris) à Hanoi, à Phnom Penh et à Ventiane (sous la supervision de l'AVRDC)
- des légumes-feuilles produits sous des filets en forme de tunnel bas à Hanoi, à Phnom Penh et à Ventiane (sous la supervision de l'AVRDC)
- l'aquaculture dans des cages flottantes à Ho Chi Minh Ville et à Phnom Penh (sous la supervision du CIRAD). L'élevage de grenouilles offre également une possibilité de diversification intéressante qui a été testée avec succès dans les deux villes.

Ces innovations ont été diffusées aux agriculteurs par le biais des associations d'agriculteurs déjà existantes ainsi que par la communication entre les agriculteurs, les conseillers agricoles et les chercheurs.

Les principaux partenaires associés au projet sont présentés dans le tableau 1.

Tableau 1- Principaux partenaires associés au projet SUSPER

	Hanoi	Ho Chi Minh Ville	Phnom Penh	Vientiane
Coordinateur local	Institut de recherche sur les fruits et les légumes (RIFAV)	Université d'Agriculture et des Sciences forestières (Université Nong Lam)	Département de l'Agro-industrie, ministère de l'Agriculture, des Forêts et de la Pêche	Département de l'Agriculture, ministère de l'Agriculture et des Forêts
Autres partenaires	Comité populaire d'Hanoi ; ministère de l'Agriculture et du Développement rural ; Hanoi Seed Company		Des ONG (*Srer Khmer*, Agrisud) ; Bureau des Affaires urbaines de la Municipalité de Phnom Penh ; Service du crédit, ministère du Développement rural ; Bureau de commercialisation des produits agricoles, Département de la planification, ministère de l'Agriculture, des Forêts et de la Pêche	

Les principaux résultats obtenus dans le cadre de ce projet peuvent être ainsi résumés :

Le projet a permis d'accroître effectivement les compétences des chercheurs et des fonctionnaires des ministères de l'Agriculture et des municipalités des trois pays en termes d'analyse du marché, d'analyse économique agricole, de systèmes d'information géographique, d'innovations techniques et de dialogue au sein des filières. Cela a été rendu possible grâce à un certain nombre de formations (voir tableau 2), d'ateliers d'échange d'information et de concertation (tableau 3) et grâce également à la préparation par des équipes mixtes nationales et internationales d'environ 90 rapports (auxquels le présent document fait référence).

Tableau 2- Activités de formation menées dans le cadre du projet SUSPER

SUJET	NATURE	LIEU	DUREE	NOMBRE ET NATURE DES PARTICIPANTS	MATERIEL DE FORMATION
Composante 1					
Présentation générale de l'agriculture à Hanoi	Visite de l'AVRDC, assistance pour l'analyse des données et l'établissement de rapports	Tainan	2 mois (28/10-01/11/02)	2 collaborateurs du projet à Hanoi, 1 du RIFAV et 1 du Comité populaire de Hanoi, Dép. de l'Agriculture	
Analyse économique agricole	Visite de l'AVRDC, assistance pour l'analyse des données et l'établissement de rapports	Tainan	2 mois (09-10/04)	1 collaborateur RIFAV du projet à Hanoi	
Analyse des systèmes de production	Visite de SUSPER-FAVRI, assistance pour l'analyse des données et	Hanoi, RIFAV	5 jours	2 collaborateurs du projet : 1 du Laos, 1 du Cambodge	

	l'établissement de rapports				
Systèmes d'information géographique	Visite, formation logicielle	CVTGeo, Hanoi	2 mois (06-07/03)	2 collaborateurs du projet à Hanoi (1 RIFAV, 1 Département de l'Agriculture, Comité populaire d'Hanoi)	
	Visite, formation logicielle	AIT, Bangkok	10 jours (11-22/08/03)		
			5 jours (9-13/05/04)	2 collaborateurs du projet à Hanoi (1 RIFAV, 1 département de l'Agriculture, Comité populaire d'Hanoi), 2 collaborateurs du projet à Phnom Penh (bureau des Affaires urbaines)	
Composante 2					
Analyse du marché	Atelier	Hanoi, RIFAV	6 jours (25/02/02-05/03/02)	21 (chercheurs et fonctionnaires) avec deux collaborateurs du projet/ville	Présentations
Analyse statistique (SPSS)	Atelier	Hanoi, RIFAV	4 jours (28/10-01/11/02)	18 (chercheurs et fonctionnaires) avec deux collaborateurs du projet/ville	Livret technique
Outils de négociation dans les filières animales	Atelier	Hanoi, VASI	6 jours (28/07-01/08/02)	2 collaborateurs du projet à Vientiane, MAFP, département de l'Agriculture	
Analyse de la consommation	Visite de l'AVRDC, assistance pour l'analyse des données et l'établissement de rapports	Taiwan-Tainan	4 mois (08/08-07/10/04)	2 collaborateurs du projet à Hanoi (1 RIFAV, 1 GSO)	
Système d'information sur les marchés	Atelier	Hanoi, RIFAV	5 jours (9/05/2005-13/05/2005)	20 (chercheurs et fonctionnaires) avec deux collaborateurs du projet/ville	Rapport de l'atelier
Analyse du marché	Visite de SUSPER-FAVRI, assistance pour l'analyse des données et l'établissement de rapports	Hanoi, RIFAV	15 jours (9-13/05/04)	5 collaborateurs du projet (2 du Laos, 3 du Cambodge)	
Tests rapides des résidus de pesticides	Atelier, démonstration	Vientiane, Centre phytosanitaire du MAF	5 jours (08-12/11/04)	10 membres du personnel du MAFP	
Composante 3					
Production légumière courante	Voyage d'étude	Taiwan-Tainan	15 jours (02-17/10/02)	3 collaborateurs du projet (1 RIFAV Hanoi, 1 MAFP Phnom Penh, 1 MAF Vientiane)	
Greffage de tomates et protection des plantes	Visites, démonstrations	Taiwan-Tainan	13 jours (17/04-30/05/02)	6 collaborateurs du projet (2 RIFAV Hanoi, 2 MAFP Phnom Penh, 2 MAF Vientiane)	
Production de tomates sous abri, greffage de tomates	Atelier, démonstration	Hanoi, 4 sites du projet	4 jours (5-9/05/03), 1 jour/zone	100 agriculteurs (25/zone)	Dépliant, CD, programme de télévision
	Démonstration	Hanoi, RIFAV	25/06/03	Vulgarisateurs (7) et agriculteurs de 5 districts (25 au total dont	

				5 chefs de coopérative)	
	Démonstration	Hanoi, Hanoi Seed Company	2 mois (01/07/-31/08/05)	10 employés de la Hanoi Seed Company formés par un chercheur de l'Université d'Agriculture d'Hanoi (plus une journée de formation à RIFAV)	
Production de légumes-feuilles sous des filets en forme de tunnel bas	Démonstration	Hanoi, RIFAV	25/06/03	Vulgarisateurs (7) et agriculteurs de 5 districts (25 au total dont 5 chefs de coopérative)	CD, programme de télévision, dépliant
	Atelier, démonstration (également production de tomates de contre-saison)	Phnom Penh, Dey Eth	10 jours (20-30/10/03)	23 agriculteurs	
	Visite d'une exploitation	Phnom Penh, Dey Eth	1 jour (01/06)	57 agriculteurs	
Elevage intensif de tilapias dans des cages de nylon	Atelier, Démonstration	Ho Chi Minh Ville, communes de Da Phuoc et Phong Phu	2 jours (06 et 16/07/04)	42 agriculteurs (06/07/04, Da Phuoc) et 45 agriculteurs (26/07/04, Binh Chanh)	Dépliant
Élevage de tilapias et de grenouilles	Voyage d'étude	Ho Chi Minh Ville	5 jours (15-19/11/04)	10 agriculteurs de Phnom Penh et 10 fonctionnaires du département des Pêches de Phnom Penh	Manuel sur l'élevage des grenouilles
Élevage de grenouilles	Atelier	Ho Chi Minh Ville, district de Phuoc Vinh An	1 jour (09/06/05)	55 agriculteurs	

Tableau 3- Liste des ateliers et des réunions organisés dans le cadre du projet SUSPER (à part les ateliers de formation)

REUNIONS DU COMITE DE PILOTAGE					
Lieu	Date	Nombre de participants			
Hanoi	03-04/10/01				
Phnom Penh	/02				
Vientiane	15-17/12/04				
AUTRES REUNIONS SUR LES RESULTATS DU PROJET					
Réunion sur les débouchés pour les légumes à Phnom Penh					
Phnom Penh, MAFP	15/02/05	27, dont 13 du MAFP, 3 de la municipalité, 5 d'ONG, 5 de la Coopération française, 1 de l'université			
Séminaire de clôture					
Hanoi, RIFAV (plus une journée de voyage sur le terrain à HCMV)	27-29/06/06	57, dont 8 du Cambodge, 2 du Laos, 3 de Taiwan, 2 de France et 42 du Vietnam (37 de Hanoi, 5 de Ho Chi Minh Ville). Le responsable de l'Académie des Sciences agricoles du Vietnam a assisté au séminaire. 3 journalistes et 4 responsables de coopératives légumières étaient également présents.			
Ateliers pour les acteurs au sein de la filière (présentation et discussion sur les débouchés pour les légumes)					
Lieu	Date	Nombre de producteurs	Nombre de commerçants	Nombre de conseillers agricoles, de négociants de produits agricoles, et autres	Total
HANOI					
Saisonnalité du marché					

RIFAV, avec des participants des 4 zones concernées par le projet (accent mis sur la saisonnalité)	18/04/03	7 (Ont été invités 1 directeur de coopérative et 1 producteur / zone du projet)	2 grossistes (1 Den Lu, 1 Long Bien)	7 conseillers agricoles ou vendeurs de produits agricoles, venant de différentes zones 27 fonctionnaires et agents de recherche	43
Dong Du	18/06/03	20		3 chercheurs	23
Vo Cuong	16/06/03	18	2 (collecteurs)	2 vendeurs de produits agricoles, 3 chercheurs	25
Tien Duong	06/06/03	21		3 chercheurs	24
Tien Phong	29/05/03	16	4	3 chercheurs	23
Qualité					
RIFAV	17/06/03	6 directeurs de coopérative	4 collecteurs, 3 détaillants	2 représentants d'associations de consommateurs 3 journalistes 3 fonctionnaires 10 chercheurs	31
Dong Du	10/10/03	68, y compris deux directeurs de coopérative	1 collecteur, 2 détaillants	11 agents de recherche et conseillers agricoles	82
PHNOM PENH					
Kien Svay	29/05/03	11	22 (6 collecteurs, 6 grossistes, 10 détaillants)	3	40
VIENTIANE					
Département de la Protection des plantes	08/11/02	3	6	6	15

La coopération régionale a été renforcée dans les domaines suivants :

- Analyse du marché : trois ateliers régionaux de formation ont été organisés à Hanoi (l'un sur l'analyse des marchés, un autre sur l'analyse statistique et le dernier sur les systèmes d'information du marché – voir le tableau 2), au cours desquels les trois pays ont partagé leurs expériences en matière de développement du marché des légumes et des poissons ; la connaissance du commerce de légumes entre le Vietnam et le Cambodge a été approfondie du fait de la participation d'équipes venant de ces deux pays ;
- Tests de recherche de résidus de pesticides : l'expertise du RIFAV dans le domaine des tests rapides pour déceler la présence de pesticides a été transférée à Vientiane. Des analyses visant à déceler la présence de métaux lourds dans des poissons élevés autour d'Ho Chi Minh Ville, ainsi que dans des liserons d'eau produits à Phnom Penh, ont été réalisées à l'Université de Nong Lam à Ho Chi Minh Ville;
- Aquaculture : les compétences acquises à Ho Chi Minh Ville en termes d'utilisation des cages en filet de nylon et d'élevage de grenouilles ont été transférées à Phnom Penh.

Les caractéristiques de l'agriculture périurbaine dans ces trois pays ont été décrites, l'accent ayant été tout particulièrement mis sur les systèmes de production de légumes et de poissons. Les enquêtes ont confirmé que cette agriculture périurbaine présente certaines caractéristiques spécifiques par rapport à l'agriculture rurale, d'autant plus que les fermes sont situées près du centre-ville : faible taille des exploitations ; sources de revenus diversifiées dans les ménages (bien que l'agriculture constitue la principale source de revenus) ; recours généralisé aux produits chimiques ; mais, dans le même temps, accès à des formations sur la lutte intégrée des pesticides (IPM) prodiguées par divers organismes. Les contraintes principales que les agriculteurs ont citées sont les problèmes de commercialisation et, pour les légumes, les inondations pendant la saison des

pluies (ainsi que les pénuries en eau à Phnom Penh pendant la saison sèche). La prédominance des problèmes de commercialisation peut sembler surprenante, étant donnée la proximité des marchés urbains. Mais il s'agit là d'un problème assez typique des produits périssables et saisonniers.

Une analyse poussée des débouchés encore inexploités par les agriculteurs périurbains a permis de traiter des problèmes de commercialisation. Cette analyse s'est appuyée sur diverses enquêtes réalisées auprès des consommateurs et des commerçants. Deux stratégies principales permettant aux agriculteurs de légumes de gagner des parts de marché ont ainsi pu être définies : l'approvisionnement en légumes de contre-saison ainsi que celui en légumes considérés comme sains par les consommateurs. S'agissant des légumes de contre-saison, les études de marché ont montré que les prix des tomates ainsi que ceux de certaines variétés de choux dans les trois pays considérés pouvaient varier du simple au double entre mai et novembre par rapport aux autres mois de l'année. Pendant cette période, les légumes sont importés des pays voisins (de Chine pour le Vietnam, de Thaïlande pour le Laos, du Vietnam pour le Cambodge). Les importations diminuent dès que la production locale augmente. Par ailleurs, les agriculteurs qui sont en mesure de produire des légumes portant la mention « sains » et de les commercialiser directement auprès de clients ou d'acheteurs spécifiques, comme les cantines des écoles, peuvent réaliser des profits plus importants et d'augmenter les quantités vendues. Cette capacité est néanmoins compromise sur le long terme par le manque de confiance des consommateurs dans le système actuel de certification ainsi que la faible traçabilité dans les filières de production légumière. Au Laos et au Cambodge, la qualité sanitaire des légumes est aussi un critère clé dans le choix de légumes par les commerçants qui présument que les produits locaux sont plus sûrs que les produits importés (ce qui a été confirmé par des tests rapides sur la présence de résidus de pesticides réalisés par le RIFAV). Pourtant, la traçabilité et l'étiquetage des légumes font défaut au Laos et au Cambodge, alors qu'il pourrait s'agir d'un bon moyen pour les agriculteurs de faire valoir leurs produits.

En ce qui concerne les poissons, les consommateurs d'Ho Chi Minh Ville sont peu conscients des risques liés à l'élevage de poissons dans des eaux polluées. Des analyses menées par l'Université Nong Lam ont pourtant fait apparaître une teneur trop élevée en métaux lourds (de l'arsenic en particulier) dans les poissons élevés dans des eaux polluées par les usines situées à proximité. Parmi les espèces de poisson élevées dans les zones périurbaines, le tilapia rouge est celle qui présente le plus fort potentiel commercial.
Les informations relatives aux possibilités de débouchés pour les légumes ont été présentées à tout un ensemble d'agriculteurs, de commerçants, de consommateurs, de chercheurs et de conseillers agricoles à l'occasion de divers ateliers dans les trois pays. Au cours de ces ateliers les besoins des agriculteurs en matière d'informations régulières sur le marché, ont été évaluées. Les agriculteurs ont demandé que des informations sur les prix soient diffusées quotidiennement par la télévision (à Hanoi) ou par la radio (à Phnom Penh et à Ventiane).

Suite aux évaluations de la production et du marché, des solutions techniques et institutionnelles ont été testées et évaluées afin de permettre à l'agriculture périurbaine de mieux répondre à la demande du marché et par conséquent de générer des revenus plus élevés pour les agriculteurs. Les conclusions relatives aux circuits d'approvisionnement du marché en produits ont permis d'aider à la sélection de zones de production pour les autres volets du projet, en fonction de leur importance et de leur continuité dans l'approvisionnement de la ville, leur éloignement géographique des sources de pollution et leur prise en considération par le Département municipal ou provincial de l'Agriculture dans les plans de développement. Ces conclusions ont en outre permis de rendre disponibles des données chiffrées sur le rôle des zones périurbaines en matière d'approvisionnement des citadins en produits frais, s'agissant en particulier des légumes-feuilles et de certaines espèces de poissons. Ces conclusions présentent un intérêt particulier pour les personnes en charge de la planification urbaine à Hanoi et à Phnom Penh.

Les solutions techniques testées les plus réussies sont indiquées ci-dessous:

- La production à Hanoi de tomates de contre-saison grâce aux techniques de greffage. Les plants de tomates greffés sur des porte-greffes d'aubergine sont résistants au flétrissement

bactérien et sont moins endommagés par les inondations. Il est donc possible de repiquer les tomates en août et d'en faire la récolte d'octobre à décembre quand les prix sont deux fois plus élevés qu'en saison sèche, les tomates étant en partie importées de Chine.

Picture 1 - Formation pratique sur le greffage de toamte au RIFAV (@ H. de Bon)

Les agriculteurs se sont approvisionnés en plants de tomates auprès du RIFAV ou de la Hanoi Seed Company, une société semi-privée qui a appris grâce à SUSPER à produire des plants de tomates greffées. Les prix de vente varient entre 200 et 500 VND (0.01 à 0.03 USD) par plant selon les quantités achetées.

- L'aquaculture dans des cages en nylon flottantes à Ho Chi Minh Ville et à Phnom Penh.

Pictures 2 - (Cages traditionnels en bois) 2 et 3 (cages en nylon) - @ Boun-Tieng Ly

Les solutions institutionnelles qui se sont révélées être les plus efficaces sont les suivantes :

- Systèmes d'information et de consultation sur les marchés (*Market Information and Consultation Systems*, MICS) sur la saisonnalité du marché légumier à Hanoi, à Vientiane et à Phnom Penh ;
- Étiquetage et certification des légumes sains à la coopérative de Dong Du à Hanoi.

Picture 3 - Tomates et carambole emballées et labellées avec la coopérative

Picture 4 - Le magasin de la cooperative de Dong Du au marché de Gia Lam

@ P. Moustier

Certains indicateurs d'impact ont été regroupés dans le tableau 4 (voir également le tableau 5, réalisations du projet). Le nombre des bénéficiaires directs reste limité, mais les solutions techniques et institutionnelles qui ont été testées avec succès dans le cadre de ce projet peuvent maintenant avoir valeur de modèle et être diffusées par les organismes de conseil agricole concernés.

Les activités suivantes ont été difficiles à mettre en œuvre et leurs résultats sont restés faibles ou mitigés :

1) La production de tomates sous abri plastique: Le problème majeur est lié au fait que les abris en plastique sont endommagés par les forts orages.
2) La production de tomates de contre-saison au Laos et au Cambodge : Bien que des essais dans certaines zones aient donné lieu à des résultats prometteurs et que des programmes de formation aient été organisés pour des agriculteurs, le suivi du travail auprès des agriculteurs sur le terrain a souffert de problèmes de retards et de logistique, notamment la difficulté à trouver des sociétés de semences susceptibles de collaborer pour fournir aux agriculteurs des plants greffés.
3) De même, le travail relatif aux systèmes d'information sur les marchés n'a pas avancé aussi bien que prévu au Laos et au Cambodge, du fait de retards dans la mise en œuvre sur le terrain. C'est ainsi que les bulletins d'information sur le marché ont bien été préparés, mais n'ont pas été diffusés auprès des agriculteurs.
4) Les urbanistes à Hanoi n'ont pas suffisamment été impliqués dans le travail sur les systèmes d'information géographique (SIG). À cela, diverses raisons peuvent être avancées, comme la difficulté à sensibiliser le Comité populaire d'Hanoi sur cette question (en dépit du fait que des employés du Département de l'Agriculture du Comité populaire d'Hanoi aient été impliqués dans le projet). D'un autre côté, la formation sur les SIG et le transfert de l'expertise de SUSPER en matière d'agriculture périurbaine ont contribué à la définition du plan d'aménagement urbain de Phnom Penh. Il est également à noter que le projet SEARUSYN, financé par l'Union européenne, et qui porte spécifiquement sur l'intégration de l'agriculture dans la planification urbaine à Hanoi, a donné des résultats intéressants, en particulier au niveau de l'amélioration du dialogue portant sur l'intégration de l'agriculture dans la planification urbaine entre les autorités du district de Giam Lam, commune de Dong Du, et le Comité populaire d'Hanoi (http://www.searusyn.org).
5) Le travail sur les associations d'agriculteurs a été mené principalement en rapport avec la Composante 2 sur le développement du marché : mise en place de systèmes d'information sur le marché et de consultation, soutien apporté aux groupes d'agriculteurs pour la commercialisation en commun, étiquetage et certification à Dong Du, Hanoi. Il était initialement prévu que les agriculteurs s'organisent en groupes afin de bénéficier de conseils

et de services conjoints relatifs aux innovations techniques. Cependant, les essais et les démonstrations sur l'efficacité de ces innovations ont pris plus de temps que prévu, si bien que le travail auprès des agriculteurs n'a pu se faire que pendant la dernière année du projet. D'autres projets touchant au conseil, comme le projet DIALOGS au Vietnam (financé par l'Union européenne et coordonné par le GRET), disposaient de ressources humaines limitées, ce qui a nui aux coopérations envisagées à l'origine. Heureusement, la diffusion des innovations est facilitée par les liens positifs qui existent entre le projet SUSPER et la Hanoi Seed Company au Vietnam et l'ONG *Srer Khmer* au Cambodge, ainsi que par l'existence effective d'associations d'agriculteurs préalablement à la mise en place du projet. Au Vietnam, les coopératives jouent toujours un rôle d'interface entre les agriculteurs et les services de conseil agricole. Dans certaines d'entre elles, les agriculteurs sont organisés en « groupes pour la production de légumes sains » et reçoivent dans ce cadre des formations sur l'IPM par des ONG, par exemple ADDA. Ce sont alors les responsables des groupes ou bien les responsables de coopérative qui organisent les contacts avec les clients. Au Cambodge, des associations similaires ont été organisées par *Srer Khmer*.

Certaines suites du projet sont présentées ci-après :

- Au Vietnam, l'ICARD va continuer le système de renseignements sur les prix avec le soutien de la Banque asiatique de développement (BAD) ;

- L'étiquetage et la certification des produits vont être poursuivies en 2006 et les contacts entre les associations d'agriculteurs et les acheteurs vont être favorisés, en particulier dans le district de Hoai Duc, province de Ha Tay. Cela sera fait grâce au soutien des autorités de cette province et de MALICA (Markets and Agriculture Linkages for Cities in Asia), un consortium regroupant le CIRAD, l'Académie vietnamienne des sciences de l'agriculture (VAAS) et l'Institut des politiques et stratégies pour l'agriculture et le développement rural (IPSARD), en coopération avec le projet « Markets for the Poor » de BAD/DFID. Un travail similaire va être entrepris dans les zones rurales montagneuses du Vietnam et du Laos dans le cadre du projet « Relier les agriculteurs ruraux aux supermarchés et autres chaînes de qualité » soutenu par le Fonds international de développement agricole (FIDA).

Dans les trois pays, le projet a mis l'accent sur le transfert des méthodes de recherche et d'intervention au travers d'ateliers et de publications, ce qui va permettre d'assurer la pérennité de la plupart des actions entreprises, même si des financements doivent être trouvés pour en élargir l'échelle.

Tableau 4- Indicateurs d'impact des principales activités de développement du projet SUSPER

	Nombre d'utilisateurs	Accroissement de la production	Augmentation des revenus	Autres indicateurs de réussite	Pérennité des actions menées
Greffage de tomates (voir Ha, 2006, infra, 3.1.6)[5]	Hanoi, Tien Duong: 20; Vinh Phuc, Tien Phong: 1 Hanoi, 21 agriculteurs de liaison de la Hanoi Seed Company (districts de Tay Ho, Gia Lam, Long Bien, Soc Son, Tu Liem) Total des ventes de plants greffés par le RIFAV en 2005 : 12 000[6] et en 2006 : 10 000 (équivalent à 3 600m²), y compris 3 000 à Tien Duong Total des ventes/dons par HSC en 2005 : 50 000 Total des ventes/dons par HSC en 2006 : 10 000 (y compris 3 000 à Tien Duong)	Tien Duong: 18,6 t/ha contre 14,1 t/ha (accroissement de 31%) pour 7 agriculteurs ou 0t/ha pour 6 agriculteurs	Tien Duong: 50 $ contre 0 ou 17 $ pour le cycle de production de tomates en été, superficie moyenne de 368 m^2 (x3) 1150 $/ha contre 0 ou 687 $/ha	12/20 des agriculteurs interrogés à Tien Duong veulent continuer Les trois agriculteurs et le responsable de la coopérative de Tien Duong, présents lors du séminaire de clôture de SUSPER, ont fait l'éloge des avantages de cette technique. Ventes de plans par le RIFAV dans diverses provinces (Hanoi, Hatay, Bac Giang, Bac Ninh, Hai Phong)	Transfert de savoir-faire à la Hanoi Seed Company qui commercialise les plants auprès des agriculteurs, mais un suivi économique et technique par les agriculteurs serait utile.
(Phnom Penh : voir Centmill, 2005, infra, 3.1.8)	Phnom Penh : 18 agriculteurs (districts de Kien Svay et Saang)	8 à 25% d'augmentation en fonction des variétés et des saisons	De 10 (choux chinois) à 120 $ (oignons d'hiver) pour 300 m^2 Comparé aux revenus négatifs sans les filets.		Prix inférieurs avec l'utilisation de filets en forme de tunnels bas. Le fait de ne pas pulvériser de pesticides sans protection est même plus avantageux et devrait être encouragé.
Tilapias en cages faites de filet de nylon (voir Hung and al, infra, 3.2.2)	Le nombre d'éleveurs de tilapias est passé de 8 à 92 autour d'HCMV	Production multipliée par 18,2 (de 600 à 10 930 tonnes) entre 2002 et 2006	Bénéfice net total des nouveaux éleveurs : 1,24 million de dollars (soit 13 000$/éleveur?)	L'élevage s'est étendu aux zones périurbaines ainsi qu'à la région du delta du Mékong	Équipements fabriqués localement moins onéreux que les cages utilisées initialement. La pratique s'étend par imitation. Il doit néanmoins y avoir un suivi des risques pour l'environnement.

[5] La comparaison a été faite entre 30 agriculteurs de Hanoi qui recourent aux filets en forme de tunnels bas et 9 agriculteurs qui ne les utilisent pas (3 à Ha Tay, 3 à Vinh Phuc, 3 à Hanoi).

[6] En 2005, SUSPER finançait l'achat des plants à hauteur de 400 VND l'unité, le producteur ne devant payer que 100 VND (pour un prix total unitaire de 500 VND); en 2006, les agriculteurs devaient payer 350 VND pour un plant vendu par le RIFAV et 500 VND pour un plant vendu par la *Hanoi Seed Company*.

Systèmes d'information et de concertation sur les légumes à Hanoi (voir An and al, infra, 2.11)	100 000 producteurs de légumes[7]	80 % des utilisateurs en ont fait mention (grâce à des prix plus élevés) mais non chiffrée.	Les trois agriculteurs et le responsable de la coopérative de Tien Duong, présents lors du séminaire de clôture de SUSPER, ont fait mention des avantages des informations sur le marché.	Système peu onéreux (s'appuyant sur les commerçants faisant office de contacts) : 6 500 $, 10 légumes Le système est maintenant géré par MARD-ICARD.
Systèmes d'information et de concertation sur les légumes à Phnom Penh (atelier du 29/05/03) (voir An and al, infra, 2.11)	11 agriculteurs, Kien Svay 22 commerçants		Évaluation lors de l'atelier : Tous les participants ont trouvé utiles les informations sur les marchés et les interactions avec les commerçants.	
Étiquetage et certification Dong Du Hanoi (voir Moustier, infra, résumé C2)	70 agriculteurs	De 30% pour le magasin de la coopérative (une augmentation annuelle d'environ 1 000 $)	Contrat en 2003 avec un exportateur de plantes (3 000$ de revenus)	Partage des coûts pour la certification : 60 % par la municipalité, 20 % par la coopérative, 25 % par SUSPER

[7] Ce chiffre prend en compte un total d'environ 150 000 agriculteurs de légumes dans la municipalité d'Hanoi et sa périphérie en province, sur la base de la superficie totale consacrée la production légumière (7 570 hectares – voir Phuong Anh and al, 2004) et la superficie moyenne consacrée à la production légumière (500 m^2 par exploitation – voir l'introduction au volet 1, infra). L'étude d'impact de MICS a montré que 75 % des agriculteurs de légumes regardent les prix des légumes à la télévision, à la fois dans les zones où le projet a été mené et en dehors de celles-ci.

Tableau 5- Résumé des principales réalisations de SUSPER par rapport aux attentes

Activité prévue	Ce qui a effectivement été réalisé
Analyse des système de production et de l'information géographique	Fait dans les 4 villes. Accent mis sur les légumes et les poissons. SIG à Hanoi et à PP Évaluation économique partielle.
Identification et suivi des opportunités commerciales	Fait dans les 4 villes. Suivi permanent à Hanoi
Test des innovations	Fait dans les 4 villes
Diffusion des innovations auprès des agriculteurs	Fait à des échelles variables suivant les villes
Promotion des organisations d'acteurs et des services	Principalement pour la commercialisation à Hanoi, à PP et à Vientiane Promotion de l'approvisionnement en semences à Hanoi par une entreprise privée
Renforcement des capacités	➢ Fait dans les 4 villes pour nos instituts partenaires (instituts de recherche, université, ministère de l'Agriculture, ONG *Srer Khmer* au Cambodge) : formation, ateliers ➢ Formation d'agriculteurs ➢ Lien avec les urbanistes au travers d'une collaboration avec d'autres projets (SEARUSYN/Wageningen et l'université d'Agriculture de Hanoi; projet de planification urbaine à Phnom Penh financé par la France).
Coopération régionale	Domaines principaux : ➢ Aquaculture (sud du Vietnam et Cambodge) ➢ Systèmes d'information sur les marchés (3 pays) ➢ Recherche de résidus de pesticides (nord du Vietnam, Cambodge, Laos) Échange d'informations sur les autres sujets par des ateliers régionaux et échanges de documents.

Component 1

Analysis of Peri-urban Production Systems

Note: In the project organisation, Component 1 involved the analysis of present peri-urban production systems (focused on vegetable-based systems in Hanoi, Phnom Penh and Vientiane and on fish-based systems in Ho Chi Minh City). Specific research on animal production systems and spatial analysis was conducted in Hanoi and Phnom Penh. The economic analysis of technical innovations tested in the project was also part of Component 1, but it has been included in the Component 3 section on technical innovations in this report.

The introduction to this section focuses on vegetable-based production systems in Hanoi, Phnom Penh and Vientiane.

Peri-urban Vegetable Systems in Vietnam, Laos and Cambodia

Mubarik Ali, Socio-economist, AVRDC-The World Vegetable Center[8]

1. INTRODUCTION

By 2025 as many as 5.3 billion people or about two-thirds of the world's projected population will be living in urban areas (UNFPA 1996). In Asia, 70% of the population will be located in cities by then. This will generate a tremendous additional demand for food, especially high value products like fruits and vegetables. In addition, fast growing incomes in urban areas will create a demand for food quality and safety (Ali et al., 2006). Unless peri-urban production in and around cities is properly supported, these trends may lead to the importing of large quantities of food from faraway places with aggravated stress on the city environment.

Several definitions of peri-urban agriculture are available (Ellis and Sumberg 1998). In this paper, it is referred to commercial crop production in a city as well as in its adjacent districts/provinces. The study regards peri-urban agriculture as a "system" with its unique characteristics in comparison with the rural (non-adjacent to city) and upland intensive systems in the context of vegetable production. Despite the historical importance of the peri-urban system in supplying fresh vegetables to cities, the system is challenged by increasing land, labour and water demands owing to alternative uses (Moustier and Mbaye 1999), imported food from faraway producers within the country and abroad and most often policy bias against urban agriculture. Moreover, intensive applications of pesticides, untreated animal manure, nitrate and phosphate fertilizer and use of wastewater create problems such as high pesticide residues, heavy-metal contamination and pathogen infection. These practices go against the increasing demand for food quality and safety associated with urbanisation and enhanced incomes. Moreover, the small-scale production of individual farmers makes them unable to meet the large quantity demands of the new integrated markets such as supermarkets. These challenges are more serious for fresh food produce in the peri-urban system such as fruit and vegetables. Recently, serious doubts have been cast on the ability of the peri-urban vegetable production system to meet these challenges (Midmore and Jansen 2003).

In this study, however, I argue that farmers in peri-urban areas are relatively better educated, possess higher managerial skills and have better access to information and input-output markets. They more quickly understand the changes in market demands and are leaders in adopting agricultural technology. They have comparative advantage in getting organised into cooperatives to overcome the economies of scale disadvantage. Therefore, the system is not just a niche market that emerged out of market failure as some researchers have postulated. (Ellis and Sumberg 1998) It has a long-term competitive advantage to meet the challenges posed by changing consumption patterns, emerging demands for food quality and safety and evolving marketing systems. The farmers in the system have the ability to lay out procedures for the production and export of quality foods that can be scaled up by farmers in other systems. These advantages of the peri-urban system are due to its proximity and connectivity to urban markets, which have been properly recognized as a critical factor in agricultural development (Christiaensen et al. 2003; Tiffen 2003; Bah et al. 2003; Erenstein 2006). The objective of this study is to provide quantitative evidence on the competitive edge of the peri-urban system, highlight its role as a leader in technology adoption and its ability to best meet the emerging challenges in agriculture due to its proximity to the urban

[8] Note by Paule Moustier: This paper is an abridged version of the paper entitled "Peri-urban Vegetable Systems in Southeast Asia: Challenges and Opportunities", presented at the ISHS symposium, Seoul, August 13-19, 2006 and forthcoming in Acta Horticulturae, combined with sections of the PowerPoint presentation by Mubarik Ali entitled "Analysis of the Peri-urban Production System" at the SUSPER final seminar, Hanoi, June 26-30, 2006. I did not get feedback on the present paper version sent to Dr Ali, who left AVRDC in January 2007. Hence I take the responsibility of the revisions made on the original paper.

centres. Another objective in line with the development objectives of the SUSPER project is to highlight the major constraints facing farmers and recommend lines of action to deal with them.

The next section develops the data utilised in this analysis. Section 3 discusses different spectrums of peri-urban systems of varying importance in supplying vegetables to cities. Section 4 discusses the physical environment in which the lowland peri-urban system generally functions and highlights the characteristics of the system in comparison with the rural system, including its role as a leader in technology adoption. The last section provides an overview of the peri-urban system with the transformation it is expected to go through in the wake of the changing economic environment and market demand.

2. DATA

The paper is based on SUSPER surveys conducted in peri-urban areas of Hanoi, Phnom Penh, and Vientiane during 2002-03[9] (see Table 1 and Table 2). These surveys mainly focused on farm characterization, including the following: farm size; family labour availability; education of the operator and family members; ownership of farm assets and machinery; livestock ownership; land and soil types; water regime; frequency and size of home garden; sources of input purchases; output distribution channels.

Table 1- Highlights of SUSPER Activities from 2003-2006

Activities	Hanoi	Phnom Penh	Vientiane
Collection of macro-statistics	√	√	√
Characterization surveys	√	√	√
Production monitoring survey	√		
Ex-post technology evaluation	√	√	√

Table 2- Area and Population of Selected Asian Cities

Feature	Unit	Hanoi	Vientiane	Phnom Penh
Population	Million	2.85 (2002)	0.69	1.19 (2002)
Total area	km^2	918	180	375
Agriculture area	ha	42,539	11,418	8,000
Population density	Persons/km^2	3,100	176	2,624
Agriculture population	(%)	24	50	37
Population growth by birth	(%)	1.7	2.2	3.0
Population growth by migration	(%)	1.5	-	0.5

[9] For Hanoi, see Mai Thi Phuong Anh and al (2004); for Phnom Penh, Em Huy, Paule Moustier (2005); for Vientiane, V. Khennavong, and al, 2006. All reports are available on http://www.avrdc.org/susper.

Due to delays in conducting the surveys, analysis and reporting, it was not possible to supplement them with data on input-output quantities and costs except in Hanoi where a production monitoring survey was implemented. Data obtained in the peri-urban areas was compared with data from rural areas collected during 1998-99 in Cambodia, Laos, Southern and Northern Vietnam under the CLV-network project of AVRDC financed by the Asian Development Bank (for Hanoi, the SUSPER survey involved a sample drawn in rural areas, but it was not used in this analysis). The CLV sample was not stratified with respect to production systems, but the spread of the survey across the whole country/region enabled us to make such a division by grouping districts and villages into urban, peri-urban and intensive rural systems in Northern and Southern Vietnam. The farm survey data were complemented with macro-level data on climatic conditions, population, agricultural area, vegetable prices and trends in land use pattern of the cities.[10]

3. CHARACTERIZATION

Despite varying spectrum of peri-urban systems in supplying vegetables across Asia, the system has some common physical and production characteristics that distinguish it from the rural systems and generate specific constraints and opportunities. These characteristics are discussed in the following section (see Table 3).

Table 3- Major Constraints Quoted by Vegetable Farmers (% of farmers)

	Hanoi	Phnom Penh	Vientiane
Flooding	12.8	80	73
Low output prices	54.6	75	98
Marketing problems	49.0	92	89
Cost and lack of inputs	29.6	90	60
Labour shortage	0.4	39	56
Water shortage	6.5	60	76
Lack of seeds	12.2	-	72
Land shortage	-	70	-

Sources: For Hanoi, Mai Thi Phuong Anh, Mubarik Ali, Hoang Lan Anh, and To Thi Thu Ha, 2004. Urban and Peri-urban Agriculture in Hanoi: Opportunities and Constraints for Safe and Sustainable Food Production, 78 p.; for Phnom Penh, Em Huy, Paule Moustier, 2005 Baseline Characterization of Urban and Peri-urban Vegetable Production in Phnom Penh, 38 p.; for Vientiane, V. Khennavong, K.Phouangphet, T. Bounyasouk, T. Vongsipasom, Boun-Tieng LY, P. Moustier, 2006. Baseline Characterization of Urban and Peri-urban Vegetable Production in Vientiane, RIFAV, Hanoi, 76 p. All reports are available on http://www.avrdc.org/susper.

Environment

The Southeast Asia region has a typical tropical climate with a monsoon rainy season from May to September, a cool dry season from October through January when the average temperature drops to about 10-25^{o}C, and hot dry season from February to April when the temperature can reach as high as 40^{o}C. Most of the rain comes from May to September while October to March is almost dry. These climatic conditions impose two serious constraints on vegetable production in Southeast Asia: Flooding and high humidity in the wet season and drought and water shortage during the dry season. These constraints are more serious in peri-urban areas as most cities in Southeast Asia lie in the lowlands. Flooding and water shortages are especially constraining in Phnom Penh and Vientiane (see Table 2). As vegetables are difficult to produce when flooding occurs or in a hot, wet situation, these environmental conditions result in a pattern of seasonality regarding the availability of vegetables in Southeast Asian cities.

[10] Note by P. Moustier: In SUSPER Component 1, trends in the land use pattern were also supported by multi-layer geographical data, especially in the project sites in Hanoi (in cooperation with CVTGeo) and Phnom Penh (in cooperation with the Bureau of Urban Affairs of Phnom Penh municipality). The lack of a permanent SUSPER expert on GIS working on the project has prevented us from finalising the existing draft reports on these activities.

Farm and Household Characteristics

In this section, farm and household characteristics that influence the competitiveness of peri-urban and rural vegetable systems are compared.

Size of Holding. Usually, it is claimed that the peri-urban vegetable system has a smaller operating size and therefore cannot compete with rural and upland systems where the size of land holding is large and can deliver output in big lots. However, our comparison of holding size across the two systems did not support this hypothesis. For example, the average land holding in peri-urban Hanoi and peri-urban Vientiane was bigger than rural Hanoi. In Southern Vietnam, the average land holding of the peri-urban system was slightly smaller than for rural areas. Only in Phnom Penh the average size was significantly smaller in urban compared with rural systems, and land shortage was stated as a major constraint by farmers (see Table 4).

Table 4- Household and Farm Characteristics and Access to Farm Resources by Production System in Selected Countries/region of Indochina Countries

	Northern Vietnam			Laos		Cambodia	
	Hanoi	**Peri-urban**	**Rural**	**Vientiane**	**Rural**	**PP**	**Rural**
Source of data:	(2)	(1)	(1)	(2)	(1)	(2)	(1)
Resources							
Farm size (m^2)	2,607	2,565	2,400	18,000	13,223	5,600	8,336
Cultivated farm size (m^2)	2,176			13,500			
Size of vegetable plot (m^2)		492	337	-	-	-	-
Size of cereal plot (m^2)		1,467	1,746	11,278	9,272		
Education of household head (years of schooling)	8	8	6	7.3	5.7	5.3	4.6
Family labour working off farm (% of household)	19	77	39	50	20	60	11
Total family income (US$/year)		371	226	-	-	1191	163
Off-farm income	342	229	116	528	-	386	48
Farm income	532	142	110	-	-	806	115
Source of vegetable seed							
Home produced	2	37	24	24	64	53	58
Local market/other farmers		24	50	34	36	26	41
Sale agent/input dealer	3	40	26	30	-	21	1
Other/combined	98	-	-	12	-	-	-
Ownership of resources (% of farmers with…):							
Refrigerator		1.2	0.6	79	34	4	0
Television		82	75	95	69	79	45
Motorcycle		37	32	45	39	45	35
Water pump		10	4	90	68	61	35
Irrigated area (%)		98	90	81	40	84	30
Canal		70	38	23	43	38	33
Tube well/open well		-	-	34	22	23	20
Water reservoir/river		30	62	9	35	39	37
Combined		-	-	34	0	0	10
Tractor		1	0	49	7	0	0
Sprayer		82	76	80	30	0	0

(1) CLVnet surveys, 1998-1999; (2) SUSPER C1 surveys, detailed in Mai Thi Phuong Anh and al for Hanoi, Em Huy and Moustier (2005) for Phnom Penh and Khennavong and al (2006) for Vientiane. Note: For Phnom Penh, income data should be viewed circumspectly as the variance in incomes is very high. This data is different than the data in Mubarik Ali's original paper after some mistakes have been corrected by P. Moustier in Em Huy and Moustier (2005).

Unlike land holding, however, the vegetable plot in the peri-urban system was smaller compared to rural systems on all sites, except for Phnom Penh. The same comparison holds for the rice plot. The smaller size of the vegetable plot in peri-urban areas is somehow compensated by the higher diversity of the cropping system, i.e. most farmers in the peri-urban system grow a greater number of vegetable crops compared to the rural system.

Better informed and connected farmers. Urban vegetable farmers were generally more educated than their counterparts in rural areas. The peri-urban farmers also had better connection with the markets as reflected by the higher percentage of farm families linked with off-farm jobs, higher off-farm earnings and a higher percentage of farmers using purchased vegetable seed. Moreover, the main source of those farmers who purchased vegetables was a town market or input dealer compared to the rural farmers who mainly exchanged vegetable seed with fellow farmers or purchased it from the village market, where seed quality is considered to be relatively poor.

The role of market connectivity in agricultural development has been extensively discussed in the literature.

Better access to resources. Peri-urban farmers not only own more household belongings such as a refrigerator, television or motorcycle, but they also have more farm resources such as water pumps, a tractor and sprayers compared with their counterpart rural farmers, suggesting that they are making more investment in their farms, earning more farm and off-farm income and living better lives. The difference is higher when both peri-urban and rural systems are less developed, such as in Phnom Penh and Vientiane, suggesting the difference between the two systems reduces with economic development (Table 3). Moreover, a higher percentage of urban vegetable farms are irrigated and the majority are connected with more developed irrigated sources such as canal, tube well/open well or combined rather than the river/reservoir source for rural farmers where they have to wait for nature to fill the reservoir (Table 3).

Types of crops grown (Table 5)**.** Rice was the major crop grown on the sample farms both in peri-urban and rural areas (even though the sample was chosen to include a majority—at least 90%—of farms with vegetable production). As expected, the proportion of the area devoted to vegetable production was higher in peri-urban than in rural systems. From a given vegetable area, a higher share was allocated to leafy vegetables in the peri-urban compared to the rural areas, while the opposite was true for stem and root vegetables. The proportion of heading cole vegetables had higher share in peri-urban compared to rural system in Northern Vietnam while opposite was true for Southern Vietnam and Cambodia. The opposite relative shares for fruit vegetables were observed in the three systems.

Table 5- Percentage of Area Allocated to Cereal and Vegetable Group by Production System in Vietnam and Cambodia

	Northern Vietnam		Cambodia	
	Peri-urban	Rural	Phnom Penh	Rural
Cereals	41.3	34.3	38.1	76.8
Vegetables	47.4	40.3	54.0	12.0
Stem & root	24.4	34.1	0	12.2
Heading cole	30.2	22.4	8.1	21.6
Fruit type	26.9	34.5	51.7	32.0
Leafy	18.4	9.0	30.8	17.2
Others	11.3	25.4	10.9	10.9
Crop diversity	2.4	1.9	1.8	1.6

Source: CLVnet surveys, 1998-1999 for Vietnam and rural Cambodia; Em Huy and Moustier (2005) for Phnom Penh.

One peculiarity of the peri-urban system in comparison with the rural system was its higher crop diversity as measured by the Herfindhal Index[11] in Northern Vietnam, Southern Vietnam and Cambodia, which implies that every farmer is growing a greater number of crops in the peri-urban system than the rural counterpart.

Peri-Urban System—Leader in Technology Adoption

Because farmers in the peri-urban system are better educated and better connected with input and output markets compared with the farmers in rural systems, the former system is the leader in agriculture technology adoption as reflected by higher quantities of fertilizer and manure used and a greater number of pesticide sprays applied on cereal crops as well as on vegetables in peri-urban systems compared with rural systems (Table 5). In Southern Vietnam, the quantities of fertilizer applied to cereal crops and vegetables were slightly lower in the peri-urban than in rural systems, which was compensated by significantly higher quantities of manure applied to crops in the former system. In fact, the Southern Vietnam peri-urban system provided a good example of helping the city environment by recycling its waste. Although quantitative data is not reported here, more farmers in the peri-urban system used advanced management practices such as mulching, stalking, raised bed, etc. compared to their counterpart farmers in rural systems. This leads to higher labour requirements in the peri-urban system, especially in Northern Vietnam. The difference in input quantities and management practices between the peri-urban and rural systems was more pronounced in Laos and Cambodia than in Vietnam.

4. CONCLUSION

In addition to economic viability, peri-urban vegetable production has several multi-functionalities, such as providing jobs to unskilled labour, especially to those with an agricultural background, preserving the green spaces, recycling city solid waste and wastewater, reducing traffic congestion, etc. (Ali et al. 2005). Peri-urban vegetable production contributes to the aesthetic properties of the urban-rural divide. Green vegetation around cities has a good impact in general on human health and people's well-being (Smardon 1988). Pfeffer (2000) points to the increased appreciation felt by urban people for goods and services other than primary products provided by urban agriculture.

The peri-urban agriculture production system is bound to change along with the changing economic environment, such as increasing wages and competition for land, labour and water for non-agriculture uses, as well as an increased demand for food quality and safety (Ali et al. 2006). Clearly, cultivation of cereal crops in peri-urban areas will no longer be profitable. It will increasingly concentrate on fresh vegetables (with a short-shelf life such green leafy produce), indigenous and quality vegetables. It will also focus on improving food quality and safety of the food chain. It is noteworthy that marketing problems were stated as major constraints by peri-urban farmers (see Table 2). The connection with food importers and the future potential connection with supermarkets will increasingly engage the system to target foreign or domestic high value integrated market demands. In terms of technology, more emphasis will be on automation to save labour, rationalisation of input use, especially fertilizer, manure and pesticides, and value addition activities such as grading, sorting, packaging and processing. The proportion of off-farm income in peri-urban areas will increase over time. Wang (1997) reported a similar transformation for the Shenyang-Dalian extended metropolitan region in the province of Liaoning in China where land use was completely shifted away from rice cultivation to a predominately vegetable production system and from an agricultural to a non-agricultural dominated work force over a 15-year period. Such transformation in peri-urban areas has profound impacts on the rural agricultural system and life-style of the people engaged in it. With appropriate policy support, the peri-urban system will pull up the rural agricultural production system to its level. Without policy support to the urban system, the rural system will be left leaderless.

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[11] The Herfindhal Index of diversity was measured as DI = $[\sum_{i-1}^{m} S_i^2]$ where *DI* is diversity index, S_i is share of the *i*th crop in total area of all crops (Escalante and Barry 2001).

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1.1 Urban and Peri-urban Agriculture in Hanoi: Opportunities and Constraints for Safe and Sustainable Food Production

Author(s): Mai Thi Phuong Anh, Mubarik Ali, Hoang Lan Anh and To Thi Thu Ha
Date: Nov 2004
Pages: 78
Published on website: Y
Published on hard copy: Y by AVRDC (Technical bulletin n° 32)

Despite all the resources and potential for urban and peri-urban agriculture, the city of Hanoi has a food production deficit. This is true of both seasonal and annual commodities. Moreover, the quality of food marketed in terms of hygiene and safety is poor. Our estimates suggest that half of every person's food requirement in Hanoi is imported from other provinces. This amounts to a total deficit of more than 600,000 tons of food. Most of this has to come from further than the peri-urban peripheries as these areas barely meet their own requirements. The food gap especially in urban Hanoi, with its increasing population and incomes, may further widen unless technological and institutional innovations are introduced in the agricultural production and marketing systems of the city. Urban Hanoi is more efficient in producing vegetables, especially leafy types. If all the cereal-producing areas were re-allocated, almost all leafy vegetable needs could be met by the urban production. Although the city still has to import all its cereal needs, the cost of importing cereals will be much less than for vegetables and transportation constraints will be eased. There is not much arable land left in the urban area and this limited resource will only continue to undergo urbanisation. There is great potential to expand non-land based food production, such as livestock and poultry, in peri-urban areas of the city. However, the environmental cost of these activities should be seriously considered and activity should be organized on commercial basis away from congested populated areas. Feed manufacturing should be encouraged. The scope of extension services should be widened to include the livestock and poultry sub-sectors and animal health coverage could be improved by involving the private sector. The marketing of livestock and poultry products needs investment to make sure they are hygienic, by encouraging the private sector to invest in marketing infrastructure and introducing cooperative marketing schemes amongst farmers.

The most forceful way to enhance food supplies from urban and peri-urban areas sources is to introduce technological innovations to both production and marketing systems. New low-cost crop varieties, livestock/fish breeds combined with improved management techniques can boost production. Moreover, new heat and humidity tolerant vegetable species and protective cultivation can reduce seasonality in supply. A constraint however to introducing these technologies is the very small size of holdings and farmers' limited financial capabilities. The involvement of the private sector in the input supply systems needs to be strengthened. The low quality of seed seriously affects crop productivity. Legal and financial constraints need to be removed to encourage healthy competition in seed and seedling production and distribution, which can be expected to lower seed and seedling cost. Encouraging cooperative marketing can also increase farmers' access to certified seed sources and reduce costs. Competitive new private sector produced feeds can also boost livestock and fish production. Many farmers face water shortages, and so use untreated drainage water, which has serious food-safety consequences. Distribution systems are inefficient and should be improved to enhance access to irrigation and methodical planning should be incorporated to ensure maximal use of water and human labour. Indiscriminate use of pesticides on crops, especially vegetables, has serious health and environmental consequences. With increasing pollution, crop cultivation in the city faces serious contamination problems from air and water pollutants. Demand, both domestic and from tourists, for higher quality, safe food is increasing. Farmers need to be trained in good management practices and various food safety management systems, such as the Hazard Analysis and Critical Control Point (HACCP).

The peri-urban system of Hanoi has all the resources required not only to meet the need of its population but also supply food to urban residents. However, peri-urban production also needs technological and institutional support to enhance its productivity and efficiency. Marketing of agricultural products needs special attention for this purpose.

1.2. The Economic Analysis of the Peri-urban Production System in Hanoi

Author(s): To Thi Thu Ha and Mubarik Ali
Date: 2007
Pages: 40
Published on website: no
Published on hard copy: no

To have details on crop management practices, input use, and production cost and return, we conducted a survey during April-June 2003 in the same communes selected in the 2002 survey. Twenty farmers from each commune were randomly selected for interview on detail crop management practices and input use.

With an average farm size of 2,880 m^2, farmers need to have good cropping practices to feed their family. Cereals, particularly rice which represent more than 50% of cultivated areas, are still the main crops in the sample areas, followed by vegetables. Flower crops only represent 5% of planted areas. Rice is only used for home consumption and to maintain the farm land, while vegetables are the major cash crops. Among vegetables, tomato, bitter gourd and cabbage dominate. Vegetables and flower crops require much more labour than rice (730, 1850 and 270 labour-day in their whole crop cycle, respectively). Production cost of vegetables, particularly fruit vegetables and cucurbits and flower crops, are much higher than cereals. It is to be considered if farmers want to shift from cereals to vegetable and flower production.

The economic analysis of crop production can also be helpful in determining the credit requirements of the sector. For example, if an average farmer with a holding of 2880m^2 wants to shift 50% of crop area from rice to vegetable or ornamental production, s(he) will require respectively 2 million or 8 million VND or (US$125 or US$510) in every crop season.

Vegetables and flower crops are highly profitable and provide an opportunity for small farmers in urban areas to enhance their income. But these crops require more investment and are riskier than rice. Therefore, technological innovations that can reduce production costs and stabilize their yields or policy intervention that can cover farmers' market and production risk will induce the production of high value crops

1.3 Peri-urban Livestock Production Around Hanoi, Vietnam: Pork Production Around Hanoi City: Constraints and Opportunities

Author(s): Vincent Porphyre, Trân Long, Ta Bich Duyen, Hélène Beaujouan
Date: Sep 2002
Pages: 22
Published on website: Y, French version

To characterise pork production around Hanoi, a survey was conducted on 267 households located in Soc Son, Thanh Tri and Gia Lam districts.

Pork production is rather small-scale (one sow, with the sale of 5-10 piglets every two months), although some larger farms (10 to 50 sows) are observed in Dong My and Van Duc communes where authorities promote lean pig production.

Breeding pigs is one way to improve a poor farmer's life. Generally, farmers have a college education, are 35-45 years of age and have 17 years of experience in pig breeding. All admit that they did not choose this livelihood but they did not have a choice. Both husband and wife work the farm.

Ninety-five percent never received any training in pig breeding. They know that workshops are organised from time to time in their commune, however, they have never been invited to participate. They report that they read literature relating to the subject and apply the advice given. They are very interested in caring for and rearing piglets, breeding techniques, reproduction, feeding and animal treatment/nursing. Farmers say that they are devoting more attention to the quality of their products to adapt to market demands. Communes with a service cooperative get the administrative attention of the district or province. In these areas, farmers have more training than in areas that lack commune level associations. Farmers have expressed their wish to get more training.

The lack of funds is a major constraint that slows down the development of their livelihood. Most farmers cannot extend their production scale, improve their buildings or invest in new breeds for better quality. Only 10% of them can afford to do so. And 50% of farmers are in a position to borrow money from State organisations. These loans have interest rates of 0.5%- 0.9% per annum. However, the amount of the loan is too small ($66- $130) and for too short a period (12 months). With these limitations, most consider the money irrelevant and do not risk a loan.

Market information is found at the market or in interchanges with neighbours. All farmers sell their animals to slaughterhouses after direct negotiation. Some use balance scales, others use "clock scales" (more precise). According to the survey, prices around Hanoi do not vary much, except around Chinese New Year. Only a few communes produce for export, but the instability of the market does not encourage the producers.

Some constraints that will need to be overcome include selection of good quality piglets that will adapt to local conditions, technical advice, use and promotion of natural supplies, vaccination and control of epidemics and loans at reasonable interest rates in order to improve breeding conditions and, finally, access to supplies and equipment. Building new structures remains difficult; nevertheless, the structures are extremely important. Another constraint of importance is specific training in breeding techniques.

- Note: preliminary to the survey, a report was done on the impact of urbanisation on the status of animal husbandry around Hanoi, mostly based on secondary data and informants in the selected districts and communes. See Hélène Beaujouan, "L'impact de l'urbanisation croissante sur l'élevage autour de Hanoi, Vietnam", rapport de stage, Université de Montpellier 2, 52 p., http:www/avrdc.org/susper-

1.4 Detection of Changing Land Use in the Hanoi Peri-urban Area

Author(s): Ms. Nguyen Thi Mai Dung, AIT student
Date: Nov 2002
Pages: 76
Published on website: N
Published on hard copy: Y, SUSPER internal document

The aim of this study is to detect, delineate and map the conversion of land use in Dong Anh district Hanoi. The methodology used both current and past land use and land cover maps of the area from recent and historic satellite imagery spanning the period of study to detect and map this land conversion. The primary resource was LandSat imagery, from 1992-2001.

The land use categories include agricultural, urban areas, bare land and water bodies, and it was monitored through a nested hierarchy of land cover. Tasselled-Cap transformation techniques were applied to extract the land cover map. In addition, in order to further understand the patterns of development, the linkage between land use change and socio-economic data was studied. Field assessments confirm a high overall accuracy of the map showing land use change (85%). Results showed how urban areas have increased while agricultural lands decreased between 1992 and 2001. This study is highly descriptive and contains very relevant information for future urban and peri-urban agricultural baseline characterisations.

1.5 Spatial Decision Support System for Sustainable Peri-urban Agriculture, Two Case Studies: Hanoi, Vietnam.

Author(s): Mr. Rajep Thapa, AIT student
Date: 2003
Pages: 88
Published on website: N
Published on hard copy: Y

The Spatial Decision Support Model for Sustainable peri-urban Agriculture is a result of combining the techniques of Remote Sensing (RS), Geographic Information System (GIS) and Analytical Hierarchical Process (AHP). The model was tested on the province of Hanoi in Vietnam.

While preparing the model, the speed of urban sprawl in the peri urban area was detected at 32.14% per annum using visual interpretations and urban index techniques in the ten-year RS images. The supervised classification method was carried out and detected seven types of land use (89.59% of accuracy) using 30-metre resolution LandSat ETM+ images.

Three distinct linkages were identified as roads, water resources and markets. Roads were extracted from a topographic map of Hanoi whereas the water resources were derived from the LandSat images and the markets from the baseline survey. The accessibility of linkages for each was further measured at different scales based on the datasets. A digital soil map of Hanoi was also used in this model. Soil, land use, water resources, road, market and government policies were selected as major influencing indicators for sustainable peri-urban agriculture.

The first five indicators were scaled as high, medium, low and not suitable as per their strengths. The AHP method was applied for computing the weights of each indicator. The results of the 30 metre grid based spatial analysis were computed using a linear combination method applying the corresponding indicators' weight and identify the land use as highly suitable (308 km^2), medium suitability (115 km^2), low suitability (14 km^2) and not suitable (109 km^2) as per the peri-urban agriculture according to FAO guidelines. Finally, the government’s plans and policies indicator were analyzed descriptively where positive attitudes have been found for sustainable peri-urban agriculture.

The model provides information that might help planners and decision-makers at various levels in allocating land.

1.6 Baseline Characterization of Urban and Peri-urban Vegetable Production in Phnom Penh

Author(s): Em Huy, Paule Moustier
Date: 2005
Pages: 38
Published on website: Y
Published on hard copy: N

The main objective of the study was to appraise the constraints and opportunities of farmers in relation with their location in urban and peri-urban areas (land pressure, markets, labour, etc). Some secondary data was gathered about vegetable production in the municipality of Phnom Penh and in the provinces surrounding it. Interviews with resource persons and some field visits were organized to review the state of available information. A farm survey was conducted on a sample of 397 farmers distributed in Mean Chey, Dangkor, Russey Keo, Kien Svay and Saang, 149 of the farms being in urban districts and 248 farms in peri-urban districts. In the sample, 13 farms do not grow vegetables.

In 2002, Phnom Penh had an estimated population of 1,191,668 persons. Out of a population of 980,003 people in 2001, 353,096 (i.e. 37 percent) were farmers. The different farming areas have been identified and mapped, in particular in Phnom Penh and Kandal municipality, which supply the bulk of vegetables to Phnom Penh.

Picture 5 - Production of water convolvulus in Boeung Tumpon waste water basin

Picture 6 - A tomato garden in Sikhotabong district

@ P. Moustier

The suitable seasons for cropping in urban and peri-urban areas are the wet season from May/June to August/September and the dry season from November/December to late March/early April. The crops grown by farmers are very diversified (more than 40 crops mentioned by farmers, including 30 different vegetables). The major vegetables are cucumber, petsai, Chinese kale, lettuce and cauliflower. Vegetable farmers earn much higher incomes than non-vegetable farmers; and incomes in peri-urban areas, where land size is higher, are also higher than in urban areas. Crop yields and use of manure are low.

The major constraints mentioned by more than half farmers are, in order of importance, marketing problems, input costs, land shortage, floods and water shortages.

The survey shows some differences in the farm characteristics according to district. Dangkor is a specific district as it has more rice growing, more sandy soil, less floods but more water shortages. Saang has more diversified crops than the other districts. Kien Svay is a district with average characteristics relative to the other ones, in particular in terms of water shortages and floods. Saang and Kien Svay districts in Kandal are more suitable for vegetable production than urban districts in Phnom Penh because of water sources available (river/lake) and less constraints on land (excluding Dangkor from the comparison of land constraints).

To develop agricultural potential, irrigation systems need to be improved to ensure water for cultivation. Additionally, proper agricultural technologies must be launched at the village level to enable less seasonally dependent cultivation in and around Phnom Penh.

1.7 Peri-urban Small Livestock Production in the Kingdom of Cambodia: Bio-security in Poultry Production in Phnom Penh

Author(s): Vincent Porphyre
Date: Nov 2003
Pages: 35
Published on website: Y
Published on hard copy: N

In Phnom Penh, local poultry production is facing increasing competition from Thailand in terms of final products as well as chicks and broilers. One key feature to stay competitive is the health status of poultry production. In-depth information on hygiene and bio-security measures, farming practices and sanitary events was gathered on four farms where blood analyses were performed on *Salmonella pullorum, mycoplasmosis,* Newcastle disease and infectious bronchitis.

The study highlights the poor hygiene management practices associated with the continuous in-farm circulation of pathogens. Primarily the lack of vaccinations, cleaning and disinfection programs, ignorance about veterinary aspects and absence of a farmer's organisation are to blame. However, a lack of funds to renovate sheds is also a factor.

The facts presented regarding the sanitary status and the risky management practices used on poultry farms can clearly provide encouragement for the Animal Health and Production Department of Phnom Penh municipality. Efforts should be centred on defining development programs to better support medium-scale poultry producers.

Training programs should be included that eventually link with the Royal University of Phnom Penh. Planning that supported a farmers' organization would allow definitive improvement of overall sanitation through better control of inputs (vaccines, feedstuffs, one-day old chicks) and outputs (eggs and meat). Additionally, a separate project could consider the creation of a unified Cambodian epidemiological surveillance network that has strong links with the NAHPIC laboratory.

1.8 Baseline Characterization of Urban and Peri-urban Vegetable Production in Vientiane

Author(s): V. Khennavong, K.Phouangphet, T. Bounyasouk, T. Vongsipasom, Boun-Tieng LY, P. Moustier
Date: May 2006
Pages: 76
Published on website: Y
Published on hard copy: N

The following report attempts to characterise the urban and peri-urban agriculture of Vientiane municipality.

First, even though Vientiane is the capital of the country, one can say that it remains a rural town. Agriculture is present throughout most of the urban districts and in the towns, in particular along the Mekong riverside. The natural ecosystem of Vientiane municipality can be defined as the Mekong riverside plain. The cultivated ecosystem can be divided into three main zones according to the water resources: (1) the floodable riverbank land oriented towards high value-added vegetables in particular during the dry season; (2) the non-floodable highlands where houses are set with fruit trees and/or rainy season vegetable gardens; moreover, in some remote non-floodable alluvial terraces of Vientiane municipality, slash-and-burn rice cultivation is still practised; (3) the floodable lowlands where rice predominates in the rainy season and to a certain extent vegetables are cultivated during the dry season if water is available. Although 54% of interviewed farmers own poultry mainly for their own consumption, livestock, in particular large stock, is not so important, as producers are shifting from the use of draft animal power to the hand tractor.

On average, despite fluctuations, Vientiane municipality basically covered the rice demand of the 652,400 inhabitants of the city in 2002. Vegetables produced by the city's surrounding districts are also potentially sufficient. However, due to the seasonality of the production, the capital must import vegetables during the rainy season and export some to the other 18 provinces of the country. It seems that this is an increasing trend, as vegetable production has increased considerably in recent years, concentrated mainly on two districts and showing quite different cropping calendars according to the production location.

Picture 7 - Tomato production in Sikhottabong (@ P. Moustier)

Nevertheless, the majority of the farmers in Vientiane are rice farmers, producing twice a year if water is available, first for their own consumption. Among the 237 surveyed farmers (which purposely included 18% non-vegetable farmers and 82% vegetable farmers), 18% were pure rice cultivators, 18% pure vegetables producers and the rest (64%) a mixture of both. A farmer family cultivates on average 1.4 ha, although there are major differences. A large part of the farm families are also part-time farmers. It seems that the young members of the family have a tendency to work

outside (50% of the sampled families have at least one member working outside), bringing home a relatively high income (440,000 kip/month on average). The young generation is better educated than the older ones, and this trend may increase in the following years.

The production means are mostly owned by the farmers, whose families originate mainly from Vientiane: 93% are landowners, the rest rent their land from a few landlords. And 46% of the interviewed farmers own irrigated land.

Peri-urban agriculture is therefore seen to be on a growth curve, although the main problems stated by farmers are (1) the low profitability of the production (high input costs and low output prices); (2) pests control and (3) access to inputs like pesticides, seed and fertilizer.

1.9 Aquaculture Systems in Ho Chi Minh City

Author(s): Le Thanh Hung
Date: 2003
Pages: 30
Published on website: Y
Published on hard copy: Y

A survey of 73 fish farms was conducted from March to May 2002 to evaluate the characteristics of peri-urban aquaculture systems in four districts of Ho Chi Minh City (HCM City).

At present, aquaculture systems and production in the peri-urban areas around HCM City are well adapted to the environment and economic context. Polyculture, in which two or more species of fish are bred in the same pond with each species consuming different types of food, and fish culture/livestock or aquatic plant integration are the dominant activities. Tilapia is the main species. However, other species such as giant gouramy and carp are also raised in peri-urban areas.

Profit-cost analysis shows that an integrated polyculture system (fish and water vegetables for example) is more profitable than monoculture, by a factor of one fifth.

Fish farmers are faced with a lack of capital, insufficient trade skills and water pollution, particularly in villages near inner districts such as Tan Kien and An Lac.

1.10 Potentials and Constraints in the Development of Wastewater-fed Aquaculture Systems in the Peri-urban area of Ho Chi Minh City, Vietnam

Author(s): Huynh Pham Viet Huy, Pham Ngoc Tam, Bui Thi Phuong Thao, Tran Van Minh, Le Thanh Hung, Boun-Tieng LY
Date:
Pages: 65
Published on website: N
Published on hard copy: N

Wastewater-fed aquaculture (WFA) has long contributed to food security in Ho Chi Minh City (HCMC), offering a living to a small but significant number of urban farmers. WFA not only plays an important role in the livelihood of farmers involved but also adds significant value to the economy of the city as a whole, providing a source of cheap aquatic products to urban consumers.

WFA is widespread in two districts with eight different systems. Some systems are able to utilise efficiently the nutrient load from wastewater as a nutrient for the fishpond, whilst in others farmers have to control carefully the intake of wastewater in order to practice fish culture. Several systems integrate fish and aquatic plants using the by-products of aquatic plants as fishpond inputs.

Farmers are middle-aged inhabitants who formerly had other occupations, mostly rice farming, because of the attractiveness of the system. Farmers negotiate a long-term lease from the State. They move into the enterprise of their own initiative, learning technical knowledge from their neighbours and families, with very little support from government. Farmers consider WFA as their main occupation. Women have a higher proportion of involvement in the aquatic plant sector. WFA products are also an on-farm food source for most of the farmers involved although the degree to which farmers use their products differs among the groups.

The different costs and returns of the varied systems define the socio-economic status of households. Some systems are suited to richer farmers whilst others are suited to poorer farmers. The importance of WFA to total household income may also be different among groups due to the profitability of the different systems. Seed production, fish-livestock, fish-water spinach and water spinach systems require more investment but their profit is higher, thus households involved in these systems are in a relatively better-off socio-economic condition. Households in the remaining groups, which have lower levels of income, can be considered as relatively worse off.

Urbanisation and industrialisation are the two main threats for WFA in HCMC. Urbanisation is leading especially to the growth of housing and road construction. Domestic wastewater is being contaminated by industrial waste from uncontrolled and dispersed industrialisation, especially from household industries, which are extremely difficult to monitor. Most WFA areas are located in the highly urbanised areas and farmers have to move whenever new projects are implemented. Some farmers have sold their cultivated land due to the attractive price offered and others may be ready to change. Changing location is a possibility for the continuation of WFA activities but this is actually not an easy task for farmers. Additionally, farmers are not able to find alternative jobs; even if jobs are available, they may not be suitable for them. WFA potentially can be maintained if interventions are initiated.

If WFA is to survive, it needs institutional support. To date such support has not been forthcoming. Both the municipal and national Departments of Agriculture and Rural Development have no detailed plans for aquaculture in the development plan of the city. Apart from a broad strategy for changing the production structure of animal and plants, there is no strategy for aquaculture in any specific area. It is not included in wastewater plans. Aquaculture is not mentioned in the EIA of the ‘water quality improvement’ project, which has several direct and indirect impacts on WFA. Other overlaps in planning that ignore WFA happen in urbanisation projects where there is no close relationship to organisations related to farmers associations.

Component 2

Market Development

Market Development for Fresh Peri-urban Produce: Summary of SUSPER Project Activities

Paule MOUSTIER, CIRAD

Note: The memorandum herewith is a summary of the findings of research done cooperatively by CIRAD (Paule Moustier, Muriel Figuié, Isabelle Vagneron, Jean-François Lecoq), AVRDC (Mubarik Ali), RIFAV (Hoang Bang An, Nguyen Thi Tan Loc, Le Nhu Thinh, Ngo Van Nam, Le Thuy Hang, Trinh Quang Thoai, Nguyen Kim Chien), VASI Department of Agriculture Systems (Bui Thi Thai, Ho Thanh Son), Ho Chi Minh City University of Agriculture Faculty of Fisheries (Le Thanh Hung, Nguyen Phu Hoa, Huynh Pham Viet Huy, Bui Thi Phuong Thao), Cambodian Ministry of Agriculture Department of Planning (Chan Sipana) and Laotian Ministry of Agriculture Department of Planning (Somsack Kethongsa), Cambodian Ministry of Agriculture Department of Credit (Chhean Sokhen), the NGO Srer Khmer (Meach Centmill).

Objectives

The key objective of the "market development" component is to identify problems and solutions in order to achieve a better matching between the peri-urban supply and the urban market demand. Bringing these two aspects into line with one another relates to the quality, quantity and consistent supply of produce available on the market. A second objective is to ascertain how to disseminate relevant information on market opportunities in an efficient and effective manner to the market stakeholders to help them in their decision-making process and increase cooperation in the market chains.

Approach

I. Market Assessment

A methodological workshop on market development for peri-urban produce was held in February 2002. It was attended by two project participants from each of the four cities, as well as officials from the Ministry of Agriculture, research institutes and universities (21 participants in total). The various steps in assessing the market chains were outlined (see Table 1): (i) analysis of produce consumption, including variability in time and demand for quality; (ii) analysis of the spatial organization of the supply channels (origin of the produce on the markets and nature of intermediaries); (iii) analysis of strategies used by market chain stakeholders, particularly in terms their socio-economic objectives, investments and relationship with other stakeholders; (iv) assessment of various market performance indicators: price variability; imports; matching the supply with the demand for quality and quantity; distribution of income. This assessment led to recommendations for market stakeholders and agents working in development or public policy.

The research is based on surveys made of the market chain stakeholders, producers, retail traders and consumers (see Table 2).

Table 1- Assessment Grid - Food Commodity Chains

		Objectives	
		Assess market organization	Assess market performance
Nature of survey	Quick, periodical market surveys	Produce origin, nature of purchasers and sellers	Prices, quantities (variations throughout the year)
	In-depth interviews with producers and retail traders	Problems, objectives, relationship with purchasers and suppliers	Income, access to information
	Household surveys		Quantities, quality demand, variability in consumption time, satisfaction with regard to quality

The workshop enabled a pooling of available knowledge regarding organization of the market chains at the outset of the project:

- In the four cities, night wholesale markets are key places where producers (or collectors) come to sell produce to wholesalers or retailers.

- Produce sold at night markets is sourced variously from peri-urban zones, rural zones and imports.

- Markets are often described as unorganized, but it would be more appropriate to describe them as complex, because informal modes of organization do exist, such as relationships of trust and regular transactions among the stakeholders.

- In Hanoi, new forms of distribution—supermarkets and stores—have specific supply chains.

Subsequent to the workshop, a joint survey protocol (quick surveys and in-depth interviews) was put in place for the four cities. It is summarized below. The consumer surveys were conducted in Vietnam only and information about consumer patterns are based on secondary data in Cambodia and Laos (see Table 2).

One specific study dealt with the competitiveness of the tomato market chain in the three countries: comparing the local chain with imported tomato chains. The study was based on data collection of costs, prices and profit margins going back through one entire retail sales network to the production stage for one product (reverse cascade ascent from purchasers to suppliers). The reliability of the information was given special consideration, so in-depth interviews were carried out on a small sample (see Table 3 and Table 4). In Vietnam, an approach ascending and descending the market chains was used starting with the wholesalers (Den Lu and Long Bien night markets). In Laos a similar study was slated but could not be performed because of problems reported by the Agriculture Department involving conducting surveys in Thailand.

Table 2- Key Surveys of Consumer Patterns and Markets

Survey	Type of survey	Year	Number of surveys	Subject
1. Survey on seasonal variation of consumer patterns (Hanoi)	Survey on representative sample	2002-2003	800 households (250 Hanoi urban, 250 Hanoi peri-urban, 150 Ha Tay, 150 Hung Yen), 3 seasons	Quantities, expenses (over the last 24 hours) Appreciation of peri-urban vegetables
2. Survey on consumer perception of quality (Hanoi)	Survey on representative sample	2003	200 households	Consumption practices, perception of health risks
3. Focus group on quality preferences (tomato, water convolvulus) (Hanoi)	Focus groups	2004	55 households (in 3 groups)	Perception of quality for tomatoes and water convolvulus
4. Surveys on fish consumption (HCMC)	Survey on representative sample	2004	217 households (17 urban districts, 5 peri-urban districts)	Frequency, quantities, type of fish, preferences, criteria in choice
5. Periodical market surveys	Quick survey on representative sample	2002-2003-2004	Hanoi: 2002, 4 times, total = 1,369 traders (1/5;) and 2003, 7 times, 1,877 traders (8 to 16 vegetable types accounting for 80 percent of transactions, except for July to September when surveys dealt only with tomato and cabbage) on wholesale and retail markets Phnom Penh: 1 trader out of 5; 8 vegetable types (40 percent of consumption), 4 times a year. Total traders surveyed = 648 in 2002, 1,108 in 2003 and 465 in 2004 Vientiane: 9 vegetable types, 92 traders in June 2002 (about 1/3), including wholesalers and retailers	Nature of go-betweens between retailers and farmers, origin of produce, quantities, prices
6. Survey on vegetable sales strategies	In-depth interviews with suppliers and purchasers in the same chain	2003	Hanoi: 3 to 10 stakeholders/function type (producers, collectors, wholesalers, retailers), for 4 networks – Total of 25 producers, 15 collectors, 7 retailers Phnom Penh: 51 traders (27 retailers, 12 wholesalers, 9 collectors et 3 producers)	Quantities purchased, relationship with suppliers, including information exchange, commitments between purchasers and sellers, terms and conditions of payment, quality control
7.Survey of safe, organic vegetable market chains (Hanoi)	Cascade interviews to identify commodity chain organization In-depth interviews	2002 (and 2004 for farmer	7 stores (out of 10) and 8 retail stands (out of 10) 11 supermarkets (out of 13 selling vegetables)	Ditto

	of purchasers and sellers in the same chain	groups)	7 schools in 4 districts, 6 restaurants 4 groups of "safe vegetable" producers and 19 organic producers	
8. Surveys of fish markets (HCMC)	Quick market surveys and in-depth interviews	2004	38 collectors, 57 wholesalers (4 wholesale markets), 330 retailers (66 retail markets)	Origin of the fish, prices (variation according to season and quality), quantities, relationship between sellers and purchasers

Table 3- Number of Persons Surveyed for Tomato Chain Survey in Vietnam (June 2005)

	Tomatoes – Peri-urban, Vietnam	**Tomatoes – China**
Producers	8 (peri-urban Vietnam, Thu Phu commune, Thuong Tin district, Ha Tay province), in June 2005	8 (China, Tan Thach commune, Tran Con district, Kunming province), in November 2005
Collectors	4	4
Wholesalers	2 (1 Denlu, 1 Long Bien)	2 (1 Den Lu, 1 Long Bien)
Retailers	4	4

Table 4- Number of Persons Surveyed for Tomato Chain Survey in Cambodia (March 2005)

	Tomatoes – peri-urban Cambodia	**Tomatoes – Vietnam (Dalat)**
Producers	10 (Kandal province, Kien Svay, Moukampoul and Ksach Kandal districts)	
Collectors	3 (Kandal province)	
Wholesalers	2 (Chaba Ampou, Dumkor)	2 (Chaba Ampou, Dumkor)
Retailers	2 (Oresey, Chaba Ampou)	2 (Oresey, Chaba Ampou)

II. Market Information and Consultation Systems

Approach

In order to provide relevant market information for producer decision-making, it is important that they be consulted to ascertain their information needs as well as to discuss with all stakeholders in the market chains problems and possible strategies to see that the supply meets the demand. Market information and consultation systems are a combination of the dissemination of relevant information for marketing decisions to be made by producers, along with setting up coordination among the various stakeholders in the chains to arrive at a mutual diagnosis and an action plan to more effectively respond to market opportunities.

Regional workshop

A regional workshop on market information and consultation systems was held in May 2005. It was attended by two persons from each city involved in this type of system (20 participants in total accounting for more participants from Hanoi). The workshop highlighted the objective, concrete difficulties encountered and approaches used in market information and consultation systems based on international case studies. Details were presented on the systems existing in Vietnam, Cambodia and Laos. Methods of processing statistics and managing data were also presented.[12]

[12] See Hoang Bang An and Paule Moustier, 2006. Vegetable market information and consultation systems in the Mekong region. RIFAV, Hanoi, http://www.avrdc.org/susper, 191 p (infra, 2.11).

Market newsletters

In Hanoi, information on the status of the vegetable market was summarized in the form of six market newsletters, five dealing with variations in the supply in terms of price, quantities and origins, and one on quality management (see Table 5). These bulletins were distributed to persons in charge of cooperatives on the project sites, posted on the SUSPER and AGROVIET web sites and sent to a list of thirty or so research and development partners.

In Phnom Penh, two market newsletters were written in 2004, one dealing with the tomato market situation and the other with the cabbage market situation. In Vientiane, one bulletin was prepared in 2004 to summarize the vegetable market situation. It was to be translated and distributed by the Department of Agriculture at the conclusion of the project.

Table 5- List of SUSPER Market Bulletins in Hanoi

Number	Year	Subject
1	2002	Seasonality of vegetable market in 2002
2	2003	Management of vegetable quality
3	2003	Seasonality of vegetable market in 2003
4	2004	Status of vegetable market June-December 2004
5	2005	Status of vegetable market January-May 2005
6	2005	Status of vegetable market June-December 2005

Stakeholders' Consultation Workshops

In all three countries, consultation workshops were held among producers, sellers and development agents in order to arrive at a mutual diagnosis of market opportunities and come to a consensus about ways of taking advantage of them (Table 6). The workshops also enabled discussion of the needs felt by producers for market information.

Table 6- List of Intra-chain Stakeholders' Workshops

Location	Date	Number of producers	Number of traders	Number of extension agents and inputs dealers, and other	Total
Hanoi					
Market seasonality					
RIFAV, with participants from the 4 project sites (focus on seasonality)	18/04/03	7 (1 co-op director and 1 producer / project site invited)	2 wholesalers (1 den lu, 1 long bien)	7 extension agents or inputs sellers, from the various sites 27 officials and research agents	43
Dong Du	18/06/03	20		3 researchers	23
Vo Cuong	16/06/03	18	2 (collectors)	2 inputs sellers, 3 researchers	25
Tien Duong	06/06/03	21		3 researchers	24
Tien Phong	29/05/03	16	4	3 researchers	23
Quality					
RIFAV	17/06/03	6 co-op directors	4 collectors, 3 retailers	2 representatives of consumer association 3 journalists 3 officials 10 researchers	31
Dong Du	10/10/03	68 including two co-	1 collector, 2	11 research and	82

		op directors	retailers	extension agents	
Phnom Penh					
Kien Svay	29/05/03	11	22 (6 collectors, 6 wholesalers, 10 retailers)	3	40
Vientiane					
Department of plant protection	08/11/02	3	6	6	15

Pricing Information Systems

In Hanoi, a daily information system for vegetable prices has been put in place, summarized under Table 7 and

Figure 1 The system is relatively inexpensive (US$ 8,000 a year). It is based on a network of market traders who telephone prices in every day.

In Vientiane and Phnom Penh, some advice on the methodology was given to improve already existing systems that were set up by the FAO, in particular to consider produce of which the quality is clearly spelled out when prices are collected.

Table 7- Pricing Information System Protocol in Hanoi

Nature of data	Wholesale price, retail price
Frequency	Daily
Produce	Vegetables = tomatoes (local + imported), cabbage (local + imported), Choy sum; Chinese cabbage; water convolvulus; wax gourd; green beans; eggplant; cucumbers; eryngium (an aromatic vegetable) Average quality standards set for each vegetable
Markets	Wholesale prices: Long Bien, Den Lu, Dich Vong Retail prices: Thang Cong (intermediate prices between Mo, a working class market, and 19-12, a market frequented by well-to-do customers); Cuu Viet (peri-urban market)
Method of collection	Collected through 3 traders contacted in each market At 4 a.m. for wholesale markets and 9 a.m. for retail markets
Method of dissemination among retail traders and RIFAV	Telephone
Database	Excel and Oracle (ICARD)
Method of dissemination from RIFAV to ICARD and DA	Internet transfer (same day when collected) of tables with prices and simple comments on trends (↗ ↘) and reasons for them
Method of dissemination to farmers and development workers	- Fax/Internet transfer from ICARD to television and from ICARD to DA, and from DA to farmers (same day when collected). - Dissemination by VTV2 television everyday, 3 times a day (7:30 a.m., 6:30 p.m., 11:30 p.m.). - Dissemination through three market bulletins (one for 2004 rainy season, one for winter 2005, one for 2005 rainy season)

Picture 8- SUSPER Price Information on Agroviet Website

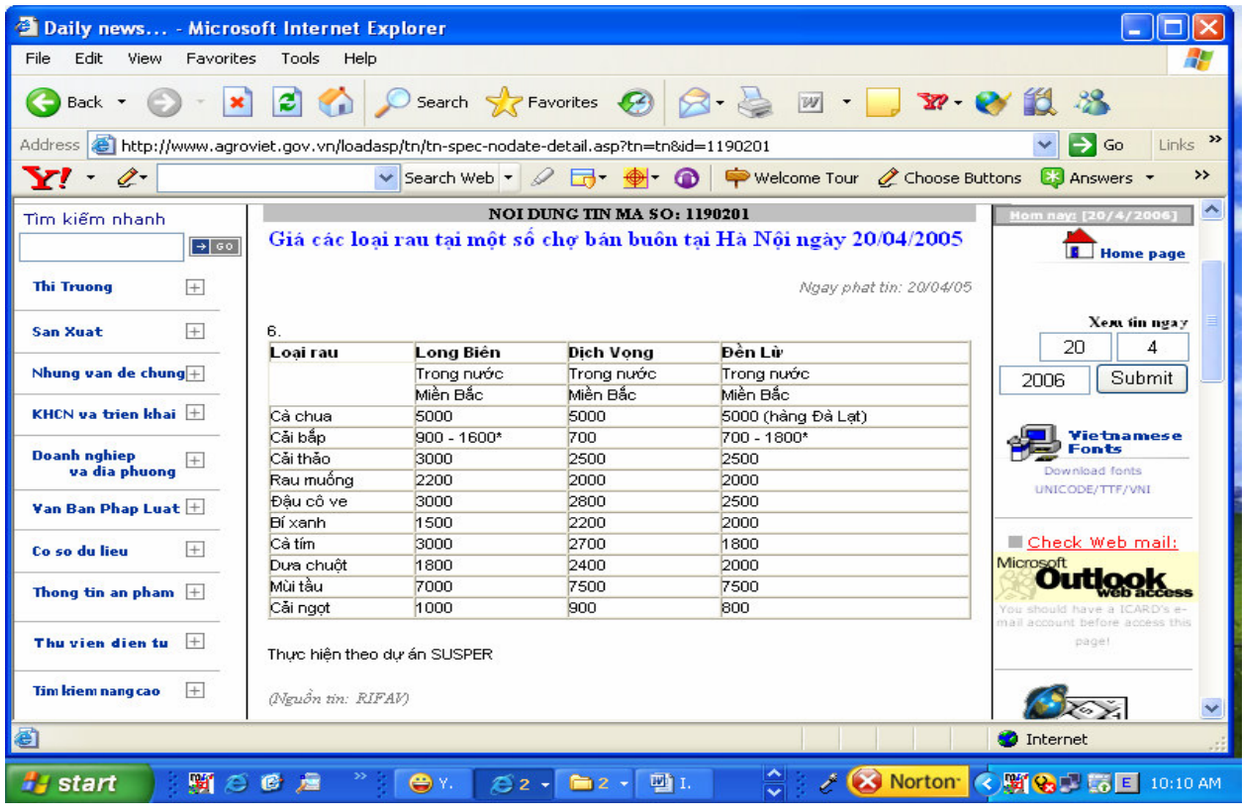
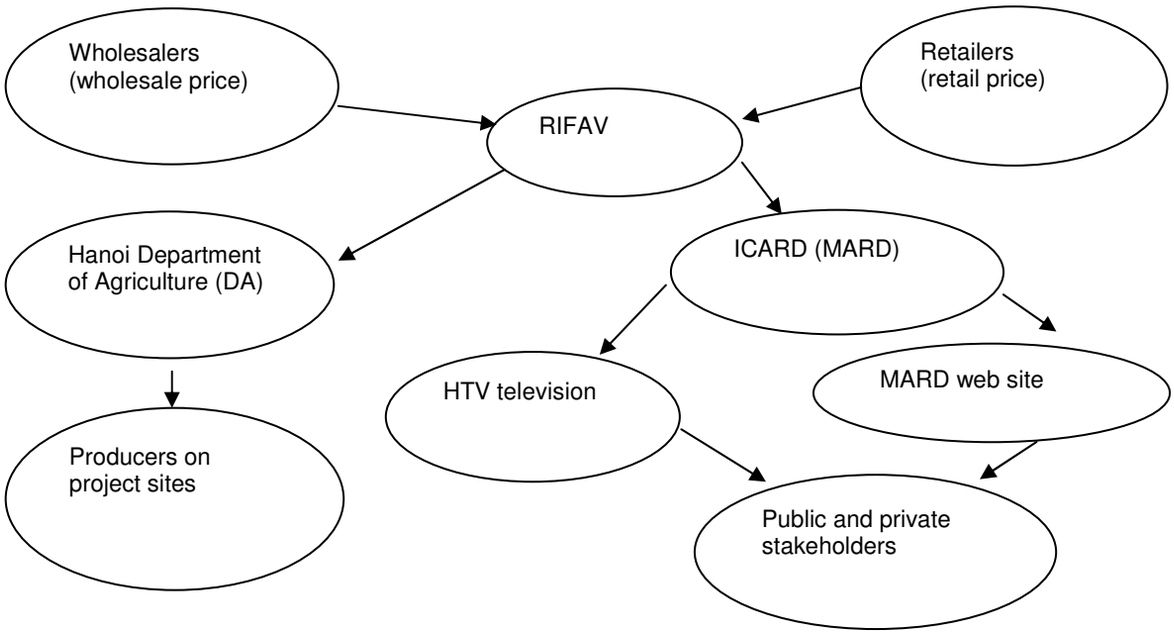


Figure 1- Price Collection and Dissemination Network in Hanoi



A survey on the impact of the price information system was conducted in March 2006 that included 100 stakeholders in the market chain: 84 farmers (including 60 on the project sites), 5 wholesalers and 11 collectors. The questions related to the access to price information, and whether and how it is used.

III. Food Safety Promotion

Research on promotion of vegetable safety in Vietnam was conducted according to the following steps:

- Analysis of consumer demand for vegetable quality and for quality signs (see Table 2);

- Analysis of the organization of the market chains in response to the demand for quality, in particular "safe vegetables" and "organic vegetables";

- Workshop to promote coordination among producers, traders and consumers on vegetable safety management in Hanoi; highlighting of two bottlenecks: (i) getting the message out to consumers on efforts put forth by producers to achieve quality and (ii) quality control;

- Communication on safe and organic vegetable chains to consumers by television and newspapers;

- Action research with a safe vegetable co-op on improving communication with consumers (communication material, product labeling) and quality control.

In a context wherein there is a very wide dispersal of production, it is more realistic and effective to promote efforts put forth by producers to achieve quality than to try to control and sanction all producers who are not compliant with the quality standards. The combination of controlling produce and controlling production practices is also recommended. With the agreement of the producers, random controls were conducted on 124 samples of vegetables from Dong Du commune (in August and November 2004, and June and August 2005), and 15 in Van Noi commune in June 2005. The samples were analyzed using a quick test (from the Taiwan Agricultural Research Institute) that determines excess organophosphorous and carbamate residues, which are from the most dangerous pesticides. Besides, 250 samples were collected in different Hanoi points of sale in 2005, and pesticide residues were analysed using quick test, as well as gas chromatography in the case of detection of excess pesticide residues by quick test.

Main Results

I. Consumers Seek a Variety of Fresh Produce

Surveys supervised by AVRDC confirmed the importance of vegetables in the diet of people living in Hanoi: 92 kg per person per year in the municipality of Hanoi (98 kg in urban districts), much higher than the FAO recommendation of a minimum of 75 kg per person per year. Leafy vegetables lead consumption (52 percent for quantity). During the rainy season, the total quantity of vegetables consumed drops (by 11 percent compared to the average) and expenses increase (by 6 percent). The drop in tuber or root vegetables, cabbage and fruit vegetables is in part compensated by the increase in consumption of leafy vegetables.[13]

In Vientiane, consumption is more limited (54 kg per person per year according to data supplied by Agrisud in 2002). Over half of the consumption is leafy vegetables along with tomatoes and cabbage. In Phnom Penh, consumption reached 109 kg per person per year in 2001 according to the Department of Agriculture (although this source has not been validated). The type of vegetables consumed is similar to the situation in Hanoi and Vientiane.

[13] Mubarik Ali, Nguyen The Quan, Ngo Van Nam, 2006, An analysis of food demand patterns in Hanoi: predicting the structural and qualitative changes, AVRDC Technical Bulletin No. 35, 61 p (infra, 2.2).

In Ho Chi Minh City, fish consumption is 34 kg per person per year based on the 2002 survey, made up of 15 kg of sea fish (mackerel, anchovies, tuna, etc.) and 14 kg of freshwater fish (snakehead catfish purchased alive, pangasius, red tilapia, etc.) and 5 kg of seafood. Fish consumption is very sensitive to the price of the fish and income level of the consumer.[14]

For both vegetables and fish, in the four project cities, the main supply of fresh produce is the neighbourhood retail market (less than 500 metres away), which may often be an informal market right on the street.

II. Local and Regional Produce Supply Channels

Importance of Peri-urban Agriculture in the Perishable Vegetable Supply

A study of the origin of produce on urban markets reveals a strong distinction according to the nature of the food items, and more particularly their perishability (Table 8, Table 9 and Table 10). The majority of leafy vegetables are brought in from zones located less than 30 km from the urban centre: water convolvulus, various types of cabbages and mustards, herbs, lettuce and green onions. These are the leading vegetables consumed, along with onions and tomatoes. They all have a very short shelf-life and their freshness drops considerably after just one day. Freshness is an important criterion in consumer choice as refrigerators are a rare commodity. In Hanoi, in 2002, over 70 percent of leafy vegetables originate within a 30-km production radius from the city. Thus, 95 to 100 percent of lettuce comes from less than 20 km away, while 73 to 100 percent of water convolvulus is grown within 10 km of the city.[15] In Phnom Penh, urban zones within the municipality supply the full lot of water convolvulus marketed in Phnom Penh (2,000 tons a year), mainly in Dangkor and Mean Chey districts.[16]

Table 8- Contribution of Various Peri-Urban Agricultural Products to City Food Supply

	Leafy vegetables	Tomatoes	Rice	All products
Perishability	→			
Hanoi (2002-2003)	70 percent	0 to 75 percent depending on season	56 percent[17]	44 percent (Ali,2004)
Vientiane (2002)	100 percent	20 to 100 percent depending on season	100 percent	
Phnom Penh (2002-2003)	100 percent (water convolvulus)	0 to 50 percent depending on season	7 percent	

[14] Le Thanh Hung, et al.,2004. Consumer Behaviour Regarding Fish in Ho Chi Minh City RIFAV, Hanoi, http://www.avrdc.org/susper**,** 21 p (infra, 2.4).

15 Hoang Bang An, Isabelle Vagneron et al., 2003. Spatial and institutional organisation of the vegetable market in Hanoi. Hanoi, RIFAV, http://www.avrdc.org/susper, 75 p (infra, 2.5).

16 Chhean Sokhen, Diep Kanika, et Paule Moustier, 2005. Vegetable market flows and chains in Phnom Penh, Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 50 p (infra, 2.14).

17 Mai Thi Phuong Anh, Mubarik Ali, Hoang Lan Anh, et To Thi Thu Ha. 2004. Urban and Peri-urban Agriculture in Hanoi: Opportunities and Constraints for Safe and Sustainable Food Production. AVRDC Technical bulletin n°32, 66 p (infra, 1.1).

Table 9- Typology of Vegetables According to Origin in Phnom Penh

- Origin accounted for over 90 percent of supply channels in 2002 -

Vegetables from Phnom Penh	Vegetables from Kandal	Vegetables from Vietnam
0 to 20 kilometres	20 to 40 kilometres	400 kilometres
Water convolvulus	Choy sum	Tomatoes (*)
	Lettuce	Cabbage
	Yard-long beans	Chinese cabbage

Table 10- Typology of Vegetables According to Origin in Vientiane[18]

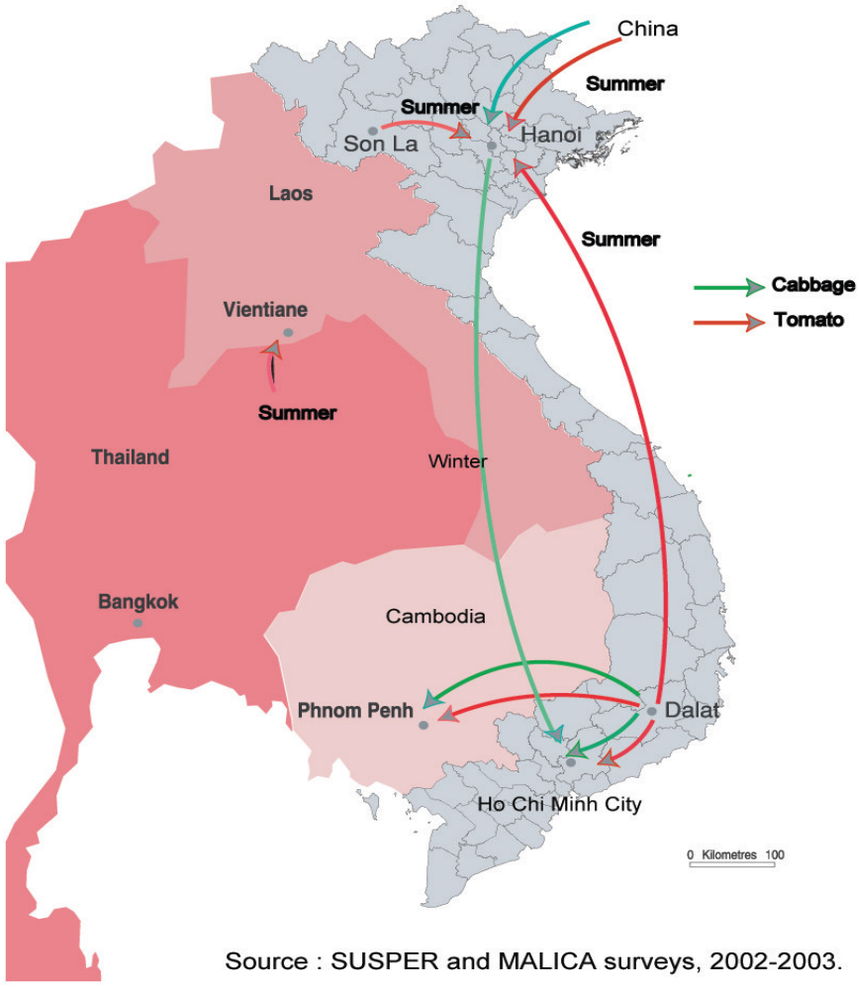
- Origin accounted for over 90 percent of supply channels in 2002 -

Vegetables from Vientiane	Vegetables from Thailand
0 to 30 kilometres	30 to 500 kilometres
Water convolvulus	Tomatoes, kale and cucumbers (between July and September)
Bok choy	
Chinese mustard	
Lettuce	
Eggplant	

For less perishable vegetables such as tomatoes and cabbage that can be kept several days without spoiling, supply channels are divided between peri-urban and rural zones. Temperate zone vegetables are sensitive to climate variations. During the rainy season, it is not so much the distance as the sensitivity of the zone to rainfall and temperature that explains the supply zones. At certain times of the year, peri-urban agriculture is not sufficient to meet the needs of consumers, which is reflected by major price hikes and large amounts of imported produce. The complementary supply from rural agriculture is then crucial, all the more so since rural agriculture can offer specific comparative production advantages during certain periods. In Vietnam, peri-urban zones have a low production potential during the rainy season due to high temperatures and heavy rainfall that are conducive to physical damage and diseases. At such times the mountain zones of China, Dalat and Son La take over from local production. While 75 percent of tomatoes are grown within 30 km of Hanoi during the cold season, 80 percent of the tomatoes sold during the hot season come from China and 15 percent from Dalat, even though it is over 1,000 km south of Hanoi (see Map 1).

[18] Somsack Kethongsa, Khamthanh Thadavong, et Paule Moustier, 2004. Vegetable Marketing in Vientiane (Lao P.D.R.). Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper**,** 56 p (infra, 2.17).

Map 1- Regional Vegetable Supply Channels



Source : SUSPER and MALICA surveys, 2002-2003.

Short Marketing Chains

In Hanoi, over 40 percent of wholesale market sellers are producers; this proportion reaches 100 percent for water convolvulus. Producers haul from 100 to 200 kilos a day, heaped onto bicycles or motorcycles, into the wholesale markets. Quantities produced in peri-urban zones are hauled over short distances often using non-powered means of transportation (carried on foot or by two-wheeled means of conveyance). This is a positive feature in terms of the final cost of the produce as well as impact on the environment. Thus, in Hanoi, all peri-urban production is hauled by two-wheeled vehicle (bicycle or motorcycle), while produce from China and Dalat is brought in by truck. Over 90 percent of water convolvulus sold is grown in gardens within 20 kilometers of the city and brought in by bicycle.

In Phnom Penh, 57 percent of retailers of water convolvulus get their supplies directly from farmers.

Short market chain for peri-urban vegetables Farmer → (Collector) → Retailer → Consumer

For rural produce, the wholesaler/collector stage is far more systematic. In Vietnam, there is a wholesaler or collector stage for over 70 percent of transactions involving rural farm produce.

Long market chain for rural vegetables Farmer → Wholesaler collector → Wholesaler distributor → Retailer → Consumer

In Vientiane, despite the short distance between the production zones and markets, the sales chains are quite complex. The combination of wholesale and retail functions is frequently observed (for over half of retail traders). Over 65 percent of the quantities marketed go through a go-between stage between the producer and retailer, even for a perishable vegetable such as water convolvulus. This may be explained by the lack of a specific place for wholesale selling, which is handled at the same place as the retail selling, as well as by the low volumes marketed (less than 200 kg per day for wholesaler and retailer alike) and the means of transportation (tuktuk being the most common).

Picture 8– A semi-wholesale stall in Kuadin market (Vientiane)

Picture 9 - A retail stall in Kuadin market (Vientiane)

@ P. Moustier

1.1. Advantage of Proximity—Freshness

In Hanoi, freshness is the key advantage for vegetable produce mentioned by 74 percent of the 500 households surveyed in 2003. In Vientiane, freshness is the key standard in selecting vegetables mentioned by the highest number of consumers (71 out of 100 consumers surveyed)[19].

1.2. Advantage of Proximity—Low Profit Margins

Research done by the Hanoi University of Agriculture (1998) assessed the marketing margin at 30 percent on leafy vegetables, 35 percent for cabbage and 75 percent for tomatoes[20]. CIRAD-VASI

19 Gerald E. Potutan, Kham Sanatem, Lynn G. Janubas, Robert J. Holmer, Wilfried H. Schnitzler, 1999. The status of vegetable consumption, production and marketing in Vientiane. Cagayan de Oro, Xavier University College of Agriculture, Periurban Vegetable Production Project, 84 p. + app.

case studies (2002) identified margins of 45 to 50 percent for cabbage[21]. This data must be weighed carefully given the large price variations throughout the year. In long-distance supply channels, wholesaler income is 10 times higher than that of the producers, retailers or collectors, but the risks of failure are also much higher because of the irregularity of production and lack of arbitration structures in the event of conflict.[22]

In Phnom Penh, urban farmers who sell water convolvulus to retailers get over 50 percent of the final price,[23] while tomato producers in Kandal (Mukh Kandal and Khsach Kandal districts), 10 or 20 kilometres outside of Phnom Penh who sell to collectors get 30 percent of the final price.[24]

Importance of Regional Trade and Influencing Factors (example of tomatoes)

Between Vietnam and China

According to information collected from the customs authorities and traders in the Long Bien market, fresh vegetable imports from China to Hanoi account for approximately 9,000 tons,[25] mainly tomatoes (3,500 tons[26]), cabbage (2,700 tons), the remainder including carrots, Chinese cabbage and various types of mustard. These imports take place between May and October, accounting for about 9 percent of the total volume of fresh vegetables consumed in Hanoi.[27]

China is the world's leading tomato producer, with 35 million tons in 2005/2006 (33 Mt in 2003).[28] Yunnan (Kunming province) is the source of the tomato production exported to Vietnam. In 2003, Yunnan's tomato production was reported to be 254,000 tons from 9,400 hectares of land area.

A comparison of tomato production in Vietnam (Ha Tay, Thuong Tin district) and China (Kunming province, Tran Con district, Tan Thach commune) points up the following differences (see Table 11 and Figure 2):[29]

- Larger vegetable plots in China (total of 2,232 m² compared to the 1,530 m² in Vietnam; 1,340 m² for tomatoes compared to 670 m² in Vietnam)

- Higher yield in China (117 t/ha compared to 61 t/ha) due to the lower temperature and lower rainfall during flowering, as well as a higher yielding variety

All Vietnamese producers surveyed cite the climate as the main problem they face in production, because the heavy rains damage the fruit. Thuong Tin district was the only one where tomatoes

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[20] Bui Thi Gia, 1999. Vegetable production and marketing in Hanoi. In: Hanoi Agricultural University and HAU-JICA ERCB project, Agricultural products marketing in Japan and Vietnam, Proceedings of the First Joint Workshop at the Faculty of Economics and Rural Development, pp. 37-47.
[21] Ho Thanh Son, Bui Thi Thai et Moustier P., 2003. Strategies of stakeholders in vegetable commodity chain supplying Hanoi market. Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 50 p (infra, 2.7).
[22] Bui Thi Thai Thai, 2000. Commercialisation des légumes d'hiver dans la zone de Bac Hung Hai. Programme Fleuve Rouge, INCO/VASI/GRET, Hanoi, 42 p.
[23] Sipana C. et Moustier P., 2005. Socio-economic strategies and results of vegetable traders in Phnom Penh (Cambodia), Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 45 p (infra, 2.15).
[24] Sokhen C. et Centmill M.. Tomato chain study in Phnom Penh. Internal document, Hanoi, CIRAD, 11 p.
[25] Total volume of vegetables imported from China (including potatoes and onions) is approximately 94,000 tons.
[26] Total tomato exports from China to Vietnam reportedly amounted to 4,754 tons in 2004 (Gain Report, 2005 – see footnote 6.
[27] Data provided by AVRDC of 76 kg of fresh vegetables consumed per person per year (i.e. 98 kg less 22 kg of dry vegetables such as onions and potatoes), a population of 1.5 million persons in Hanoi's urban districts in 2002, and deducting 13 percent for consumption out of home and 1 percent for self-supply (production and gifts).
[28] The information that follows is excerpted from: Gain Report, 2005. China, People's Republic of, Tomatoes and Products Situation, USDA Foreign Agricultural Service, 16 p., www.fas.usda.gov/gainfiles/2004 et 2005, 13 p.
[29] Information from Vu Thi Tinh, report on tomato production in China and Vietnam, 2006, internal document, RIFAV.

were being grown at the time the survey was made. In China, five of the producers surveyed mentioned marketing problems, difficulties in finding purchasers and low prices; two mentioned that low temperatures drove up production costs as this phenomenon drags out the harvest period (one month in Vietnam compared to two in China) as well as time in the nursery (two months in China, a few weeks in Vietnam).

Longer production schedule in China: in Vietnam, June is the last harvesting month (for seeds sown in January, transplantation occurring 45 days later and harvest beginning 3 months after transplantation and lasting 25-30 days); in China, the plants are sown in November or December (the winter is colder in China and development time takes longer), harvesting starts in early May and concludes in late June. In villages other than the one surveyed, producers start the young plants later (between November and January) and can harvest during the April to October period. Collectors order tomatoes at different months of the year from producers in the different villages in order to benefit from a supply that stretches between May and October. The lower temperatures make tomato production difficult (especially maturation) between November and April.

Tomato varieties: in China, variety TF415 (hybrid variety produced in China, oval, 70-80 grams), and in Vietnam varieties of VL2000 (hybrid variety produced in Vietnam, round, 100 g) or VL2910 (hybrid variety of Vietnam, similar to China' TF415).

Quality: Tomatoes from China have a more pronounced colour, are firmer and easier to transport than tomatoes produced in Vietnam.

The cost of production per unit of land is twice as high as in China, but since the yield is twice as high, the production cost per kilo is the same. This involves the cost of labour, fertilizer and other costs (such as stakes) that are higher in China. Costs of seed and insecticides are lower: firstly because industries that manufacture agriculture inputs are more present in China; secondly, producers watch for disease and avoid the use of excess pesticides. Moreover, the price to the producer is twice as low in China relative to Vietnam, so although the yield is twice as high, the producer's profit is the same.

Table 11- Distribution of Costs and Prices in Tomato Market Chains in Vietnam and China Sent to Hanoi in June 2005

Note: 1 sao = 360m^2

	VIETNAM		CHINA	
	VND/kilo	VND/sao	VND/kilo	VND/sao
Cost of labour	289	583,216	373	1,572,008
Cost of pesticide	232	469,656	110	465,405
Cost of fertilizer	224	451,784	192	810,894
Cost of seed	55	110,396	17	71,547
Other costs	138	279,357	181	758,368
Total production cost	938	1,894,409	873	3,678,223
Producer profit	2,462	4,232,370	827	2,396,179
Producer price	3,400	6,126,784	1,700	6,074,402
Total marketing cost	2,725		5,175	
Retail price	6,125		6,875	
Collector cost	147			
Collector profit	953			
Retailer cost	654			
Retailer profit	971			
Margin from collector to farm			408	

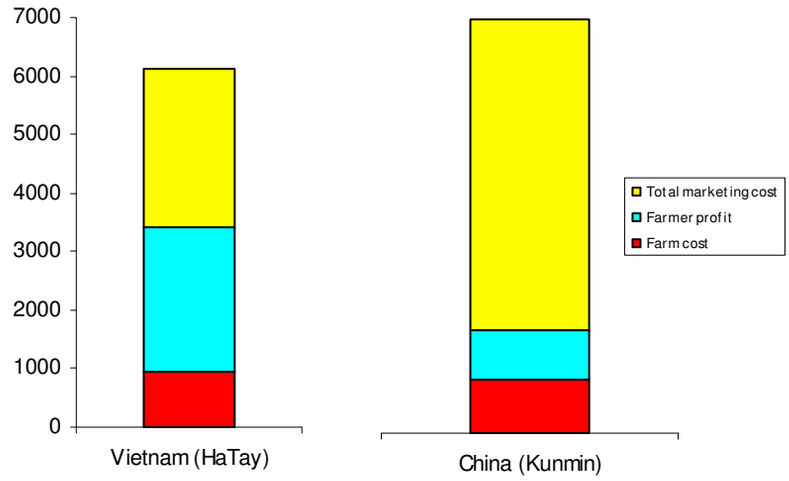
Cross-border collector cost	458
Cross-border collector profit	492
Wholesaler collector cost	474
Wholesaler collector profit	593
Wholesaler distributor cost	169
Wholesaler distributor profit	831
Retailer cost	821
Retailer profit	929

For tomatoes from China, marketing costs are logically higher than those for tomatoes from Vietnam, especially due to differences in the costs of transportation (189 VND/kilo for tomatoes from Vietnam, 612 VND/kilo for tomatoes from China), the larger number of go-betweens (4 instead of 2 between producer and retailer), as well as higher taxes (10 VND/kilo for the Vietnamese collector, 230 VND/kilo for the cross-border collector). Retailer costs are higher because the retailers are selling in markets with a more well-to-do customer base, which entails higher rental costs and taxes.

The three traders surveyed selling tomatoes from both sources indicated that tomatoes from China have a more uniform appearance and keep longer.

In both types of market chain, the relationships among the stakeholders are personalized and regular.

Figure 2- Distribution of Costs and Prices in Vietnamese and Chinese Tomato Market Chains Destined to Hanoi in June 2005 (equivalent in VND/kilo)



Between Cambodia and Vietnam

In Phnom Penh, for the eight selected vegetables that account for approximately 40 percent of the total consumed, 32,800 tons are sold, including 12,800 tons that are imported (i.e. 39 percent) and 16,400 tons (61 percent) that are local.

Comparison of tomato production in Cambodia (Kandal province) and Vietnam (Dalat) shows the following differences:[30]

- Area: 5,800 m² of tomatoes on the average in Cambodia (36 percent of total area).

[30] Chhean Sokhen and Meach Centmil. 2006. Tomato chain study in Cambodia. SUSPER internal document, 6 p.; data on the tomato chain in Dalat was collected by Boun-Tieng Ly.

- Production schedule: In Cambodia, tomato production takes place mainly during the dry season, from November to April. At the end of the dry season, from January to April, production is difficult, as well as during the rainy season (May to October). At the end of the dry season, tomatoes are produced in Kien Svay, Mukh Kandal and Khsach Kandal districts because of the proximity of water sources.

- In Dalat, the main production season is from October to April.

- Yield: The yield is 8 tons/hectare on the average in Cambodia. The lowest is 6.5 and highest 22.7 tons. This high figure is achieved with greater use of fertilizer and more costly pesticides.

- In Dalat, the yield is 175 tons per hectare for one producer surveyed. The production cost is 73,500,000 VND/ha. The tomatoes are first shipped to Ho Chi Minh City, then from Ho Chi Minh City to the border by collectors, and are then delivered to wholesalers in Phnom Penh.

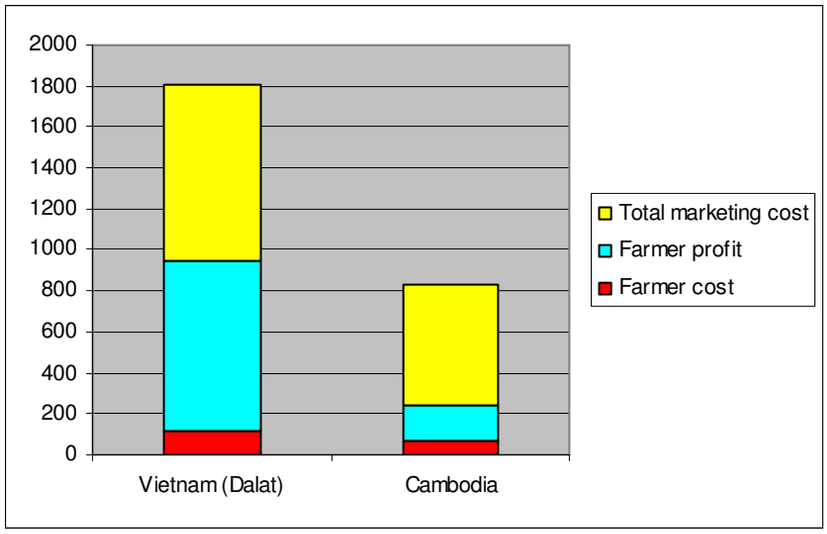
In Cambodia, labour costs include weeding, ploughing and harvesting that are paid out as service provisions. Depreciation applies mostly to spraying equipment (owned by 7 producers out of 10) and motor pumps (2 producers out of ten).

The distribution of Costs and Prices in the Cambodia and Vietnam Tomato Chain Sent to Phnom Penh in March 2006 is indicated in Table 12 and Figure 3.

Table 12- Distribution of Costs and Prices in the Cambodia and Vietnam Tomato Chain Sent to Phnom Penh in March 2006 (equivalent in Riels/kilo)

	CAMBODIA	VIETNAM
	Riels/kilo	Riels/kilo
Cost of labor	28	
Cost of pesticide	4	
Cost of fertilizer	8	
Cost of seed	3	
Equipment depreciation	17	
Other costs	4	
Total production cost	64	116
Producer profit	173	834
Producer price	237	950
Total marketing cost	591	855
Retail price	828	1,805
Collector cost	85	100
Collector profit	82	
Wholesaler cost	42	350
Wholesaler profit	83	
Retailer cost	93	131
Retailer profit	206	149

Figure 3- Distribution of Costs and Prices in the Cambodia and Vietnam Tomato Chain Sent to Phnom Penh in March 2006 (equivalent in Riels/kilo)



In both types of market chain, the relationships between the stakeholders are personalized and regular.

III. Market Information and Consultation Systems

The operation of the market information system has been presented in the section on methodology. The main results related to the use and to the impact of the system are summarized below.[31]

In the first two years of the project, we helped farmers, as well as development and research agents, to make medium-term decisions on production sites, commodities, and cropping periods, through the gathering of information on market seasonality and product origin. This contributed to the selection of the project sites by taking into account their importance and continuity in urban food supply:

- in Hanoi, Dong Du commune (Gia Lam district) as regards the supply of aromatic vegetables and cabbage,Tien Phong (Me Linh) as regards tomato supply from November until June, Tien Duong (Dong Anh) as regards tomato and choysum supply, Vo Cuong (Bac Ninh), as regards tomato supply.[32]

- in Phnom Penh, Kien Svay and Saang districts in Kandal Province.

- in Vientiane, Sikkotabong district, with diversified leafy and fruit-vegetable production.

While the imports from neighbouring countries are considered to hinder the development of local production because of “dumping prices”, the workshops in the three countries resulted in reaching a consensus between farmers, traders and research agents on the possibility for local production to substitute for imports if the following strategies are pursued: (i) targeting some specific products, including tomatoes in the three countries, at specific times of the year (including the rainy season, from June to November, in the three countries); (ii) applying off-season production techniques, including grafted tomato and varieties resistant to bacterial wilt; (iii) adapting the visual quality of

[31] Hoang Bang An and Moustier P., 2006. Vegetable market information and consultation systems in the Mekong region. RIFAV, Hanoi, http://www.avrdc.org/susper, 191 p (infra, 2.11).
[32] Mai Thi Phuong Anh, Nguyen Thi Tan Loc, Le Nhu Thinh, Ho Thanh Son and Moustier P., 2004. Basic information on the project sites in Hanoi peri-urban areas, http://www.avrdc.org/susper, 24 p (infra, 2.12).

vegetables to the needs of the consumers in line with the imported products, e.g. in Hanoi, developing the production of cabbage of small size (similar to the one from China), which has higher price per kilo than the bigger cabbage. Diversification strategies were also discussed in Vientiane, including Chinese cabbage in the dry season, and also peppermint and eggplant at the beginning of the rainy season.[33]

The demand for information on daily vegetable wholesale and retail prices was mentioned the most often by farmers and traders in the stakeholders' workshops held in Hanoi and Phnom Penh, for the following uses: targeting periods of high prices in terms of cultivation and harvest (same purpose for calendar data) and better negotiation with traders. The preferred means of dissemination by farmers is television in Vietnam and radio in Cambodia. In the three countries, vegetable exchange is characterised by a combination of spot, small-scale, occasional interactions, and regular relationships, but without rigid commitments in terms of priority sales, volume or pricing, so the amount of leeway to use market information in negotiating with traders and the choice of markets is quite high.

The impact survey of Hanoi vegetable price information system set by SUSPER demonstrates that a majority (74 percent) of farmers and traders now have access to vegetable price information through television (where vegetable prices are communicated by SUSPER). They listen to the television programme on prices everyday (62 percent) or several times a week (25 percent). The price information is used for marketing decisions, especially for bargaining with their buyers, and also for crop planning purposes. The actors not using vegetable price data are characterised by a low area for production (less than 700 m^2) and regular relationships with the buyers. Farmers recommend having price information disseminated everyday at 7:30 p.m. (rather than 6:30 p.m.). This needs to be discussed with HTV2, as this time of the day is in high demand by television broadcasters.

According to ICARD, the Ministry of Agriculture could be in a position to fund the system in 2007.

In Phnom Penh, the interviewed farmers stated that they need daily vegetable price information on radio. This is already being implemented by the Agricultural Marketing Office, but it is little known by farmers, and the reliability of the data needs to be improved by more rigour in price collection, e.g. as regards quality grading.

IV. Promotion of Vegetable Safety

Diagnosis of Supply and Demand for Vegetable Safety

Increasing Demand for Vegetable Safety

For 90 percent of the 200 households, the safety of vegetables has dropped over the last ten years. They feel that vegetables are a greater source of concern in terms of health mainly due to pesticide use.[34]

In Phnom Penh and Vientiane, the traders surveyed say they prefer to buy local produce rather than imported produce because the latter enjoys a reputation of being safer (with less chemical residues) and so is easier for consumers to purchase.

1.1. Actual Instances of Contamination

In Hanoi, banned pesticides such as Wotafox (Methyl Parathion) and Monitor (Methamidophos) were found to be used by farmers in Tu Liem district. Various vegetable samples were analyzed in peri-

[33] Lecoq J.F., 2003. Negotiation tools for vegetable commodity chains in Vientiane, http://www.avrdc.org/susper, 21 p., 2003 (infra, 2.19).

34 Figuié M., 2003. Vegetable Consumption Behaviour in Vietnam. Hanoi, CIRAD, http://www.avrdc.org/susper, 23 p (infra, 2.1).

urban co-ops between 1994 and 1995 and showed excesses of nitrates and pesticides in relation to authorized standards.[35]

In 2004, quick tests conducted by SUSPER on 25 vegetable samples from Phnom Penh retail markets and 30 from retail markets in Vientiane revealed excess pesticide residues on samples of cabbage imported from Vietnam and on peri-urban leafy cabbage (in Phnom Penh), as well as on Chinese cabbage imported from Thailand into Laos.

In Hanoi, analyses conducted by SUSPER in 2006 at various points of retail sales revealed that out of 250 samples, 9 percent had higher than standard pesticide residues, especially leafy cabbage types of peri-urban origin.[36]

In Phnom Penh, the SUSPER project conducted heavy metal analyses of water convolvulus grown in Boeng Ansaong Andaet, a wastewater collection pond south of Phnom Penh (samples were sent to the Ho Chi Minh City University of Agriculture laboratory). The analyses found zinc residues to be eight times higher than the FAO standard.[37]

In 2003, analyses conducted on fish raised around Ho Chi Minh City revealed excess levels of arsenic in An Lac village, located in an industrial zone, and zinc, for carp and tilapia (Hung, 2004).

Difficulties in recognizing quality

In 1995, public interest in the issue of vegetable health quality led the government of Vietnam to conduct an ambitious program on the "safe vegetable" theme. By 2001, this program covered 30 percent of the land under vegetable cultivation around Hanoi (2,250 hectares). It included training in proper use of fertilizers, pesticides and water. Production certificates were issued by the City of Hanoi Department of Science and Technology to cooperatives involved in this program. Also, a network of "safe vegetable" outlets was established for the distribution of vegetables produced by these cooperatives. In parallel, organic vegetable production started in 1999 at the incentive of an NGO (CIDSE).

Producers selling their vegetables under the "safe" or "organic vegetable" label can get a price 50 to 100 percent higher than for conventional production (Son, Hung Anh and Moustier, infra). However, the share of vegetables sold as "safe vegetables" or "organic vegetables" accounted for 2,200 tons in 2002 (including only about 40 tons of organic vegetables), which is less than 5 percent of household consumption in the capital and less than 2 percent of production in the municipality of Hanoi. Thus, producers who put forth a genuine effort for quality production have only limited recognition on the market. Furthermore, vegetable safety control is difficult to put in place. Firstly, production around Hanoi is widely dispersed: over 100,000 producers on land areas under 1,000 m². Secondly, there are many government laboratories in competition with one another. And finally, the cost of analysis is very high (US$20 per sample for a gas chromatographic analysis).

Organization of Market Chains for Improving the Produce Quality

Supermarkets that want to get supplies of specified quality produce go to chains that are more integrated than those supplying retail traders in market stalls. Thus, in Hanoi, supermarkets, stores, schools and restaurants are supplied directly by a small number of co-ops (three main ones in 2003, that represent about thirty hectares altogether), with which they have a customer fidelity relationship.

35 Tran Khac Thi 1999. Study on some environmental factors and solutions on safe vegetable development. Paper presented at the National Workshop on Safe and Year-round Vegetable Production in Peri-urban Areas, CIRAD/RIFAV Hanoi, 15-16 December, pp. 33-47. Unfortunately, the method used to collect and analyze samples, as well as the proportion of samples with excess residue levels, is not outlined in a precise manner.

36 Nguyen Kim Chien and Moustier P., 2006. Vegetable Pesticide Residues in Selected Fields and Points of Sale. Internal SUSPER document (infra, 2.10).

37 Internal document prepared by Boun-Tieng Ly.

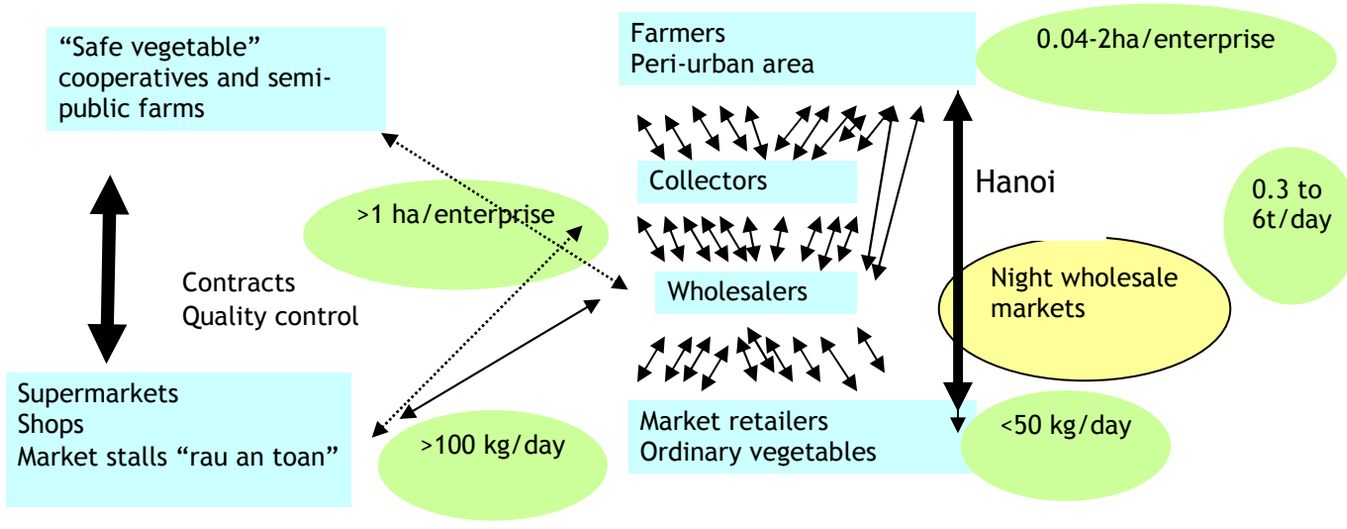
These co-ops have the technical support of "safe vegetable" programs sponsored by agriculture departments of the municipality of Hanoi (non-chemical agriculture practices) and a certificate issued by the Department of Science and Technology (but obsolete since 2001, and gradually re-implemented by the Department of Plant Protection since 2004).[38]

Proximity between production zones and the markets enables producers to make retail sales directly to consumers, which is a noteworthy guarantee of quality due to the information exchange and trust developed between producers and consumers (see the cases of the Van Tri co-op and Dong Du co-op in section 2).

The organic vegetable chain has developed due to the impetus of a non-governmental organisation (CIDSE) and now involves about 30 families in the municipality of Hanoi (Tu Liem) and in Ha Tay (Chung My). Until 2004, the NGO entered into contracts with producers for a three-month term based on fixed prices and quantities. It provided them with organic fertilizer and technical training. Since some producers have problems finding outlets, the NGO has also gotten involved in retail marketing by supporting a private company (Hanoi Organics) that has opened a store and makes private deliveries. The "safe vegetable" chain in Dalat has a similar organization. It is led by the Golden Garden Company that is bound by contract to the Safe Vegetable Producers' Association which has 35 members working 4 hectares.[39]

It is noteworthy that the analysis of pesticide residues in different points of sale in 2005 (Chien and Moustier) showed that the percentage of samples with excess residues is increasing from the organic vegetable shop (no excess residue) to the safe vegetable shops and supermarkets (1.5 percent) up to the traditional markets (10 percent).

Figure 4- Organization of "Safe Vegetable" and "Ordinary Vegetable" Supply Chains in Hanoi



[38] Moustier P., Figuié M., Nguyen Thi Tan Loc and Ho Thanh Son. 2005. The role of coordination in the safe and organic vegetable chains supplying Hanoi. 2006. In Acta Horticulturae, (699), pp. 297- 303.

[39] Dini L. 2002. *La gestion de la qualité sanitaire dans la filière des légumes à Hanoi* (Health Quality Management in Hanoi Vegetable Supply Chains). Master's degree thesis, CNEARC/CIRAD, Montpellier.

Consultation Workshops Focusing on Quality

Two stakeholders' workshops were held in Hanoi to deal with health quality problems in vegetable market chains. The first was held on June 17, 2003 at RIFAV. It was attended by 6 co-op management staff (including 2 for safe vegetables and 3 from three project sites), 4 collectors from project sites, 3 retailers (one for safe vegetables and one for organic vegetables, one regular vegetable retailer), two representatives from the consumers' association, three journalists, three government representatives and ten researchers. This workshop enabled an assessment to be made of the supply and demand situation in the realm of vegetable safety based on the findings made by SUSPER. A consensus was reached around two priorities to improve the match: (i) communication on efforts put forth by producers to achieve quality; (ii) vegetable safety control. Each of these themes was covered by working groups who made some recommendations:[40]

(i) Communication on efforts put forth by producers to achieve quality: consumer information on origin of vegetables, points of sale, health quality features

(ii) Vegetable safety control: This control must be low cost and flexible, based on internal control in the co-ops themselves. Direct sale of vegetables to consumers also makes it easier for consumers to check production conditions.

A second workshop was held at Dong Du, one of the project sites, on October 20, 2003. The meeting was attended by 64 producers, 2 co-op representatives, 3 commune representatives, one vegetable collector from Dong Du, a "safe vegetable" outlet operator, one supermarket operator, IPM project officers (ADDA) and 9 researchers. During this meeting, the "safe vegetable" production situation in Dong Du was outlined, as well as difficulties experienced by traders and consumers to find a regular supply of "safe vegetables". Traders get their supplies mainly from Van Noi cooperatives but would like to diversify their supply sources. Producers were informed of potential points of sale for "safe vegetables" as well as of consumer and trader demands regarding labelling and quality certification. Producers from Dong Du prefer direct sales to consumers and contracts with restaurants rather than sales to retail traders, because they fear they cannot meet the requirements for diversity and regularity voiced by the retail traders.

Status of Quality Promotion for Two Safe Vegetable Co-ops: Dong Du and Van Noi

Two communes where safe vegetables are produced were selected for the particular purpose of vegetable safety promotion: Dong Du (Gia Lam district) and Van Noi (Dong Anh district). They belong to the group of 33 communes involved in the 1996 "safe vegetable" program. We selected co-ops that were already applying the "safe vegetable" specifications in order to improve the thoroughness of quality control practices.

Stock was first of all taken of the production situation and marketing in both communes.[41]

Dong Du

"Safe vegetable" production involves 30 hectares of vegetables in the summer (40 hectares in winter) and 70 households organised in 5 groups. Total yearly output of these groups is estimated at 1,900 tons, and 5 billions of VND (310,000 dollars). From 2001 to 2002, ADDA (an NGO) held classes on safe vegetable production (12 courses with 30 participants per course). A similar number of training sessions had been held previously from 1996 to 2001 by departments under the People's

[40] A summary of this workshop was prepared for *Consumer* magazine: Nguyen Thi Tan Loc, Figuié M. and Moustier P., 2003, *Gap go giua cac nha san xuat, buon ban va tieu dung voi cac nha nghien cuu rau* (Meeting of vegetable researchers with farmers, traders and consumers), *Nguoi Tieu Dung* n° 137, p. 1.

[41] By Nguyen Thi Tan Loc, RIFAV, for Dong Du, and Ho Thanh Son, ASD-VASI for Van Noi.

Committee. The group leaders stated that they perform weekly controls of practices involving the use of chemicals in the fields and in outlets selling agriculture inputs.

The main avenue in which vegetables are sold is right in the field to collectors (for aromatic vegetables) or in wholesale or retail markets in neighbouring villages. A small share of the production is also sold under contract to two factory canteens (total of 500 kg/day). In 2002, Japanese Cooperation funded the rental of a stand in Hang Da Market but the co-op was subsequently unable to pay the rent and preferred to rent a stand in Gia Lam Market starting in 2004. The average quantities sold by the shop amount to 70 kilos per day (25 tons per year).

Van Noi

The Van Tri cooperative in Van Noi commune is a noteworthy example of successful collective action and vertical integration into the market chain. It is made up of 13 members who work 3 hectares and produce about 100 tons of vegetables per year. In addition to what its members produce, it makes off-season purchases of vegetables from Moc Chau producers. It exercises control over the Moc Chau production by renting land from owners on which the farmers work rent-free for 5 years and who are subject to technical control by the owners. In exchange, they receive a commission of 5 percent on the sale of vegetables. In 2004, vegetables from the co-op were being retailed through 10 points of sale, each of which was managed by a co-op member (who makes purchases from other members as well as from the Moc Chau co-op in addition to its own production), thus clearing an average of 200 kg of vegetables per day. The co-op is also selling vegetables to two supermarkets, four schools and five restaurants, with which it enjoys a customer fidelity relationship (Ho Thanh Son, 2004).[42]

Surveys of production practices were conducted with 30 households belonging to three co-ops in Van Tri village. The type of manure, fertilizer, pesticides, as well as the time between their use and harvesting were compared with standards, on the basis of statements made by the producers. This survey indicated good compliance (according to the farmers' statements) with production standards, which shows at least that they are familiar with them, although it would be difficult to actually check things out. However, for some vegetables (such as Chinese peas), the times between pesticide spraying and harvest are one day shorter than the recommended times. The recommended times are complied with for tomatoes and cabbage.

Improvement of communication on efforts to achieve quality (Hanoi)

In January 2003, a TV program was prepared with the VTV2 channel. The first part was devoted to consumer demands for vegetable quality and the organisation of existing market chains for "safe" and organic vegetables. The program was designed for an audience of consumers, producers and government officials. The second part was directed to producers, showing various techniques of growing leafy vegetables under nets.

In 2003 as well, an article was written and published in *Consumer* magazine regarding various points of sale for safe vegetables in Hanoi.[43]

Many things have also been done with the Dong Du co-op in order to improve information supplied to consumers by this co-op regarding quality efforts:

- A newsletter outlining commitments made by the co-op in the area of safe vegetable production as well as the various types of vegetables available at the co-op during particular seasons. Over 1,500

[42] Ho Thanh Son, 2004. *Organisation de la production et de l'écoulement des produits de légumes Van Tri-Van Noi-Dong Anh-ville de Hanoi* (Organization of Vegetable Production and Marketing from Van Tri-Van Noi-Dong Anh to Hanoi City). Internal document, SUSPER, AVRDC/CIRAD, Hanoi, 11 p.
[43] Nguyen Thi Tan Loc and Moustier P., 2003. *Nguoi Hanoi mua rau an toan o dau?* (Where Do People in Hanoi Buy Safe Vegetables?). *Nguoi tieu dung*, April 2003, p. 4.

copies of this newsletter were distributed, notably during three “safe vegetable” fairs held in 2003 by the Hanoi People’s Committee. These fairs involved some 50 exhibitors on the “safe vegetable” theme (most of which were production businesses);

- An information board in the Gia Lam Market store presenting information similar to that covered in the newsletter;

- Plastic wrapping and labelling of vegetables sold at the retail level, showing the address of the co-op, telephone number and “safe” production method (see label in annex). However, packaging and labelling are not carried out systematically because some consumers prefer to buy vegetables in bulk.

These steps taken in 2003 and 2004 enabled the co-op to get a contract in 2003 with an exporter of aromatic vegetables for three deliveries per week, 300 kg at a time, with a turnover of 300,000 to 400,000 VND per delivery. Besides, sales in the shop increased from 70 kg to 100 kg per day (i.e. by 30%), while returns increased from 150,000 to 200,000 VND per day.

Support for Quality Control

Support for quality control is provided in co-ops in Dong Du and Van Noi communes. Random sample collections of vegetables yielded the following results:

Dong Du

- In August and November 2004, 8 percent of samples (out of 61) were found to contain pesticide residues (involving three aromatic vegetables). After these analyses were performed, discussions took place with co-op management staff, which revealed that too little time was allowed between spraying and harvesting, and the practices were subsequently corrected.

- In June 2005, excesses were found in three types of aromatic vegetables (33 percent of samples out of a total of 33). Subsequent to these analyses, discussions took place with co-op management staff, which revealed that too little time was allowed between spraying and harvesting, likewise resulting in a correction of the practices. No residue was found in August 2005.

In Van Noi (Thon Dam village, Van Noi co-op), analyses performed in June 2005 on 15 samples showed that 80 percent of samples had excessively high residue levels. The results were forwarded to the co-op management staff and further analyses were performed with the Department of Plant Protection. Results are not yet available.

Certification in Dong Du

The project assisted the Dong Du co-op to go through the different procedures required to obtain a certificate from the Department of Plant Protection:

- Compilation of documents on the IPM training sessions received, a letter of commitment to comply with the “safe vegetable” standards, outlets selling agriculture inputs along with a list of the products sold, type of marketing, map of the production zone showing among other things the location in relation to water sources.

- Random controls with three samples of vegetables, soil and water collected and analyzed:

- For vegetables: nitrates, 7 types of pesticide, 6 types of heavy metal, 3 types of pathogen

- For soil, nitrates, 4 types of pesticide, 6 types of heavy metal

- For water, 6 types of heavy metal, 3 types of pathogen.

Out of a total cost of US$ 400 (6.6 M VND) (for 12.8-hectare area), the municipality of Hanoi provided funding at a level of US$ 240 (3.8 M VND), the co-op US$ 80 (1.2 M VND), and the SUSPER project US$ 100 (1.6 M VND). The co-op received a certificate on December 20, 2005 for a 1.28-ha area, involving a village of 24 producers. In the other villages, the group leaders do not want to be bothered with administrative procedures. Pressure from the Department of Plant Protection as well as that from purchasers is indeed limited (purchasers do not check to see if vegetables come from the area specified on the certificate).

The certificate is to be renewed yearly. In the course of the year, in June 2006, a representative from the Department of Plant Protection visited the fields to check on practices involving the use of chemicals as well as products available in outlets selling agriculture inputs. The co-op was informed in advance that this check would take place, but not the producers.

The co-op would like to renew the certificate in late 2006 at a cost of US$ 62 (1 M VND). Certificate renewal undergoes the same analysis of plants, soil and water as for the first time it is obtained, and also includes a visit of the fields and outlets.

Conclusions

The SUSPER project contributed to the capacity building of staff in Vietnamese research institutes and government offices in the area of market analysis. It also increased regional cooperation on this subject and highlighted the dynamics of the regional vegetable trade between Vietnam, Laos and Cambodia. The strong consumer demand for certified safe vegetables was highlighted and passed on to producer groups. The periods and items of produce that command the highest prices were also shared with these groups. An inexpensive system for daily price information collection and dissemination was developed in order to facilitate producer negotiation with traders. New methods of labeling and certifying the health quality of vegetables were also tested.

The findings regarding the produce market supply channels made it possible to guide the selection of production zones for the other project components, given their importance and continuity in supplying the city. These findings also make available quantified data on the role of peri-urban zones in terms of supplying city dwellers with fresh produce, especially leafy vegetables. These findings are of particular interest to persons in charge of urban planning in Hanoi and Phnom Penh (Municipality Urban Affairs Office).

Follow-up actions are shown below:

- ICARD will continue the daily price information system (with the support of the ADB);

- Continuation of produce labelling and certification in 2006, especially in Hoai Duc district, Ha Tay province, supported by Ha Tay Province and MALICA (Markets and Agriculture Linkages for Cities in Asia), a consortium between CIRAD, VAAS (Vietnam Academy of Agriculture Science) and IPSARD (Institute on Policy and Strategies on Agriculture and Rural Development), in cooperation with the ADB/DFID project “Making Markets Work Better for the Poor”.

In all three countries, the emphasis that the project placed on transferring research and intervention methods through workshops and publications is something that will ensure the sustainability of most of the undertakings, although funding must be found in order to increase the scale.

Le développement commercial des produits frais périurbains : Synthèse des activités du projet SUSPER

Paule MOUSTIER, CIRAD

Note : ce texte synthétise les résultats de travaux menés en collaboration entre le CIRAD (Paule Moustier, Muriel Figuié, Isabelle Vagneron, Jean-François Lecoq), l'AVRDC (Mubarik Ali, sur le volet consommation), le ministère français des affaires étrangères (Boun-Tieng Ly), le RIFAV (Hoang Bang An, Nguyen Thi Tan Loc, Le Nhu Thinh, Ngo Van Nam, Le Thuy Hang, Trinh Quang Thoai, Nguyen Kim Chien), le département des systèmes agraires du VASI (Bui Thi Thai, Ho Thanh Son), la faculté des pêches de l'université agricole de Ho Chi Minh Ville (Le Thanh Hung, Nguyen Thi Thanh Truc, Nguyen Phu Hoa, Huynh Pham Viet Huy, Bui Thi Phuong Thao), le département de la planification du ministère de l'agriculture du Cambodge (Chan Sipana) et du Laos (Somsack Kethongsa, Khamtanh Thadavong), le département crédit du ministère du développement rural du Cambodge (Chhean Sokhen), l'ONG Srer Khmer (Meach Centmill).

Objectifs

L'objectif principal de la composante « développement du marché » est d'identifier les contraintes et solutions pour une meilleure adéquation entre la production périurbaine et la demande du marché urbain. Cette adéquation est relative à la qualité, aux quantités, et à la régularité des produits mis sur le marché. Un deuxième objectif est d'évaluer comment une information pertinente sur les opportunités du marché peut être diffusée de manière efficace aux acteurs du marché, contribuer à leurs prises de décision et à une coopération accrue dans les filières.

Méthode

I. Evaluation du marché

Un atelier méthodologique sur le développement du marché des produits périurbains a été organisé en février 2002. Il a rassemblé deux participants de chaque ville du projet, cadres du ministère de l'agriculture, d'instituts de recherche ou universités. Les différentes étapes d'évaluation des filières ont été présentées : (i) l'analyse de la consommation des produits, notamment la variabilité dans le temps, les demandes de qualité ; (ii) l'analyse de l'organisation spatiale des flux (origine des produits sur les marchés, nature des intermédiaires) ; (iii) l'analyse des stratégies des acteurs des filières, en particulier en termes d'objectifs socio-économiques, d'investissements, de relations avec les autres acteurs ; (iv) l'évaluation de différents indicateurs de la performance du marché : variabilité des prix ; importations ; adéquation entre l'offre/demande en qualité et quantité ; distribution des revenus. Cette évaluation conduit à des recommandations pour les acteurs du marché et les agents du développement ou des politiques publiques.

Les travaux s'appuient sur des enquêtes auprès des acteurs de la filière, producteurs, commerçants, consommateurs (voir Tableau 1).

Tableau 1- Grille d'évaluation des filières alimentaires

		Objectifs	
		Evaluation de l'organisation du marché	Evaluation de la performance du marché
Nature des enquêtes	Enquêtes rapides et périodiques de marché	Origine des produits, nature des acheteurs et vendeurs	Prix, quantités (variations au cours de l'année)
	Entretiens approfondis avec les producteurs et commerçants	Contraintes, objectifs, relations avec acheteurs et fournisseurs	Revenus, accès à l'information
	Enquêtes de ménages		Quantités, demande de qualité, variabilité dans le temps de la consommation, satisfaction par rapport à la qualité

L'atelier a permis de faire le point sur les connaissances disponibles sur l'organisation des filières au début du projet :

- dans les quatre villes, importance des marchés de gros de nuit où les producteurs (ou collecteurs) viennent vendre les produits aux grossistes ou détaillants ;

- sur les marchés de nuit, les produits viennent à la fois des zones périurbaines, des zones rurales et des importations ;

- les marchés sont souvent qualifiés d'inorganisés, mais le qualificatif de complexe est plus approprié, car il existe des modes d'organisation informels, comme des relations de confiance et de régularité entre les acteurs ;

- à Hanoi, de nouvelles formes de distribution, supermarchés et magasins, ont des filières d'approvisionnement spécifiques.

Suite à l'atelier, un protocole commun d'enquêtes (enquêtes rapides et entretiens approfondis) a été mis en place pour les quatre villes. Il est résumé ci-dessous. Les enquêtes auprès des consommateurs ont été menées seulement au Vietnam, et les informations sur la consommation se sont appuyées sur des données secondaires au Cambodge et au Laos (voir Tableau 2). Enfin, une étude spécifique a porté sur la compétitivité de la filière tomate dans les trois pays : comparaison de la filière locale avec les filières de tomate importée. L'étude s'est fondée sur la collecte de données de coûts, prix et marges sur l'ensemble d'un réseau de la vente au détail jusqu'à la production, pour un même produit (remontée en cascade des acheteurs aux fournisseurs). La fiabilité des informations a été privilégiée plutôt que la taille de l'échantillon (voir Taeblau 2). Au Vietnam, la remontée et descente des chaînes s'est faite à partir des grossistes (marchés de nuit de Denlu et Long Bien). Au Laos une étude similaire était prévue mais n'a pu être réalisée, notamment à cause des difficultés invoquées par le département de l'agriculture pour mener des enquêtes en Thailande.

Tableau 2- Principales enquêtes sur la consommation et les marchés

Nom de l'enquête	Type d'enquête	Année	Nombre d'enquêtés	Sujet
1. Enquête de saisonnalité de consommation (Hanoi)	Enquête sur échantillon représentatif	2002-2003	800 ménages (250 Hanoi urbain, 250 Hanoi périurbain, 150 Ha Tay, 150 Hung Yen), 3 saisons	Quantités, dépenses (sur les dernières 24 heures) Appréciation des légumes périurbains
2. Enquête de perception de qualité par les consommateurs (Hanoi)	Enquête sur échantillon représentatif	2002	200 ménages	Pratiques de consommation, perception des risques sanitaires
3. Focus group sur les préférences de qualité (tomate, liseron d'eau) (Hanoi)	Focus groups	2004	55 ménages (en 3 groupes)	Perception de la qualité de la tomate et du liseron d'eau
4. Enquêtes sur la consommation de poisson (HCMC)	Enquête sur échantillon représentatif	2004	217 ménages (17 districts urbains, 5 districts périurbains)	Fréquences, quantités, type de poisson, préférences, critères de choix
5. Enquêtes périodiques de marché des légumes	Enquête rapide sur échantillon représentatif	2002-2003-2004	Hanoi : 2002, 4 fois, total = 1369 commerçants (1/5 ;) et 2003, 7 fois, 1877 commerçants (8 à 16 légumes représentant 80% des transactions, sauf pour juillet à septembre, où les enquêtes ont seulement porté sur tomate et chou) sur les marchés de gros et de détail Phnom Penh : 1 commerçant sur 5, 8 légumes (40% de la consommation), 4 fois par an. Total de commerçants interrogés = 648 en 2002, 1108 en 2003 et 465 en 2004 Vientiane : 9 légumes, 92 commerçants en Juin 2002 (environ 1/3), comprenant des grossistes et détaillants	Nature des intermédiaires entre détaillants et agriculteurs, origine des produits, quantités, prix
6. Enquête sur les stratégies de vente des légumes	Entretiens approfondis de fournisseurs et acheteurs d'une même chaîne	2003	Hanoi : 3 à 10 acteurs/type de fonction (producteurs, collecteurs, grossistes, détaillants), pour 4 réseaux – Total de 25 producteurs, 15 collecteurs, 7 détaillants Phnom Penh : 51 commerçants (27 détaillants, 12 grossistes, 9 collecteurs et 3 producteurs)	Quantités achetées, relations avec les fournisseurs, dont les échanges d'information, les engagements entre acheteurs et vendeurs, conditions de paiement, contrôle de qualité
7.Enquête sur les filières des légumes propres et biologiques (Hanoi)	Entretiens en cascade pour identifier l'organisation des filières Entretiens approfondis des acheteurs et vendeurs d'une même chaîne	2002, et 2004 pour les groupes d'agriculteurs	7 magasins (sur 10) et 8 stands de détail (sur 10) 11 supermarchés (sur 13 vendant des légumes) 7 écoles dans 4 districts, 6 restaurants 4 groupes de producteurs "légumes propres" et 19 producteurs biologiques	Id.
8. Enquêtes sur les marchés de poisson (HCMV)	Enquêtes rapides sur les marchés et entretiens approfondis	2004	38 collecteurs (27poisson d'eau douce, 11 poisson d'eau de mer) 57 grossistes (4 marchés de gros), 330 détaillants (66 marchés de détail)	Origine du poisson et quantités (auprès des collecteurs), Prix (variation selon saison et qualité), relations entre vendeurs et acheteurs

Tableau 3- Nombre d'enquêtés pour l'étude de la filière tomate au Vietnam (Juin 2005)

	Tomate Vietnam périurbain	Tomate Chine
Producteurs	8 (Vietnam périurbain, commune de Thu Phu, district de Thuong Tin, province de Ha Tay), en juin 2005	8 (Chine, commune de Tan Thach, district de Tran Con, province de Kunming), en novembre 2005
Collecteurs	4	4
Grossistes	2 (1 Denlu, 1 Long Bien)	2 (1 Denlu, 1 Long Bien)
Détaillants	4	4

Tableau 4- Nombre d'enquêtés pour l'étude de la filière tomate au Cambodge (Mars 2005)

	Tomate Cambodge périurbain	Tomate Vietnam (Dalat)
Producteurs	10 (province de Kandal, districts de Kien Svay, Moukampoul, Ksach Kandal)	
Collecteurs	3 (province de Kandal)	
Grossistes	2 (Chaba Ampou, Dumkor)	2 (Chaba Ampou, Dumkor)
Détaillants	2 (Oresey, Chaba Ampou)	2 (Oresey, Chaba Ampou)

II. Systèmes d'information et de concertation sur les marchés

Démarche

Afin de rendre pertinente l'information sur les marchés pour la décision des producteurs, il est important de les consulter pour connaître leurs besoins d'information, et également de débattre avec l'ensemble des acteurs des filières des problèmes et stratégies possibles pour adapter l'offre à la demande. Les systèmes d'information et de concertation sur les marchés combinent la diffusion d'une information pertinente pour les décisions de mise en marché des producteurs, avec l'organisation de la concertation entre les différents acteurs des filières pour aboutir à un diagnostic partagé et à un plan d'action pour mieux répondre aux opportunités du marché.

Atelier régional

Un atelier régional sur les systèmes d'information et de concertation sur les marchés a eu lieu en mai 2005. Il a rassemblé deux personnes de chaque ville, impliquées dans ce type de systèmes. L'atelier a présenté l'objectif, les difficultés pratiques, les méthodes des systèmes d'information et de concertation sur les marchés à partir d'expériences internationales. Les systèmes existants au Vietnam, au Cambodge et au Laos ont été détaillés. Des méthodes de traitement statistique et de gestion des données ont été également présentées[44].

Bulletins d'information

A Hanoi, l'information sur l'état du marché des légumes a été résumée sous la forme de six bulletins de marché, cinq sur les variations de l'offre en termes de prix, quantités et origines, et une sur la gestion de la qualité (voir Table 5). Les bulletins ont été distribués aux responsables de coopératives dans les sites du projet, diffusés sur les sites web de Susper et Agroviet, et envoyés à une liste d'une trentaine de partenaires de recherche et développement.
A Phnom Penh, deux bulletins de marché ont été rédigés en 2004, un sur la situation du marché de la tomate, un sur la situation du marché du chou. A Vientiane, un bulletin a été rédigé en 2004 pour résumer la situation du marché des légumes, sa traduction et diffusion devait être organisée par le département de l'agriculture après la fin du projet.

[44] See Hoang Bang An and Moustier P., 2006. Vegetable market information and consultation systems in the Mekong region. RIFAV, Hanoi, http://www.avrdc.org/susper, 191 p.

Tableau 5- Liste des bulletins de marché de SUSPER à Hanoi

Nombre	Année	Sujet
1	2002	Saisonnalité du marché des légumes en 2002
2	2003	Gestion de la qualité des légumes
3	2003	Saisonnalité du marché des légumes en 2003
4	2004	Situation du marché des légumes en Juin-Décembre 2004
5	2005	Situation du marché des légumes en Janvier-Mai 2005
6	2005	Situation du marché des légumes en Juin-Décembre 2005

Ateliers de concertation

Dans les trois pays, des ateliers de concertation ont été organisés entre producteurs, commerçants et agents de développement, afin d'aboutir à un diagnostic partagé sur les opportunités du marché et les moyens de les atteindre. Les ateliers ont aussi permis de discuter des besoins des producteurs en informations sur les marchés.

Tableau 6- Liste des ateliers de concertation intra-filière

Lieu	Date	Nombre de producteurs	Nombre de commerçants	Nombre d'agents de vulgarisation et vendeurs d'intrants	Total
HANOI					
RIFAV, avec des participants des 4 sites du projet	18/04/03	7 (1 chef de coopérative et 1 producteur /site de projet invités)	2 grossistes (1 Den Lu, 1 Long Bien)	7 agents de vulgarisation ou vendeurs d'intrants, des différents sites	43 (avec agents de recherché et administration)
Dong Du	18/06/03	20			20
Vo Cuong	16/06/03	18	2 (collecteurs)	2 vendeurs d'intrants	20
Tien Duong	06/06/03	21			21
Tien Phong	29/05/03	16	4		20
PHNOM PENH					
Kien Svay	29/05/03	11	22 (6 collecteurs, 6 grossistes, 10 détaillants)	3	40
VIENTIANE					
Département de la Protection des Plantes	08/11/02	3	6	6	15

Systèmes d'information sur les prix

A Hanoi, un système d'information journalier sur les prix des légumes a été mis en place. Le protocole est résumé dans le Table 7 et la

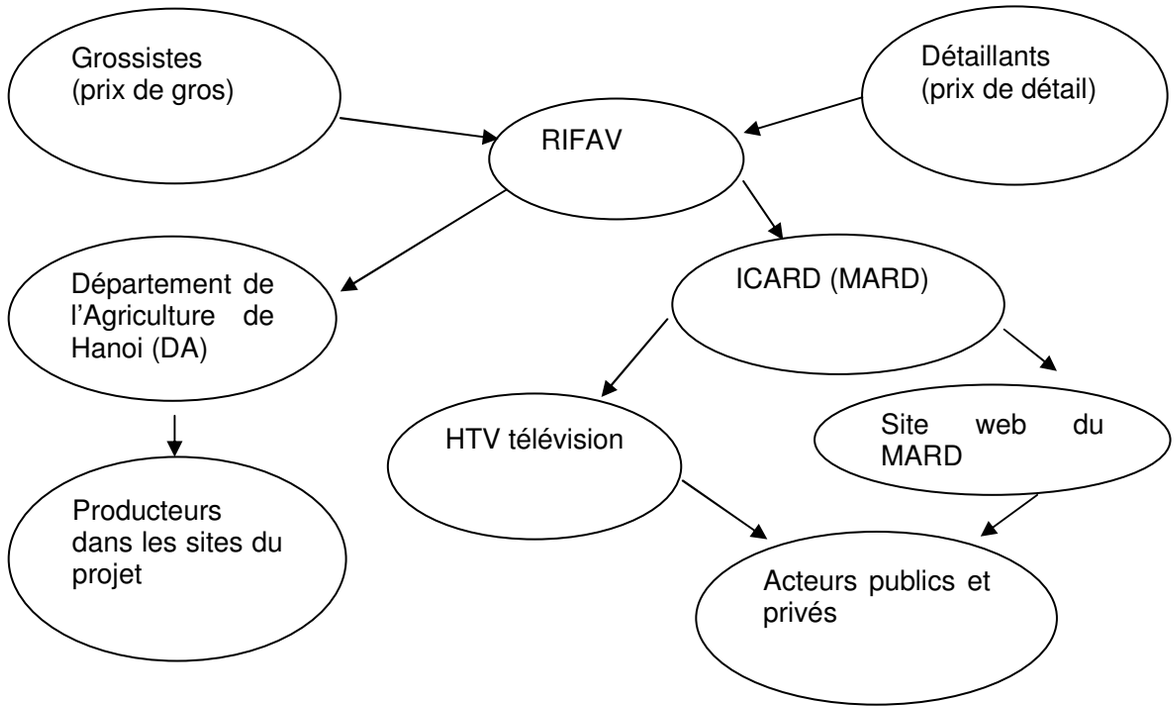
Figure **5**. Il s'agit d'un système assez peu coûteux (8000 dollars par an). Il s'appuie sur un réseau de commerçants contacts dans les marchés, qui communiquent les prix tous les jours par téléphone.

A Vientiane et à Phnom Penh, des conseils méthodologiques ont été donnés pour améliorer les systèmes déjà existants mis en place par la FAO, en particulier pour considérer des produits de qualité bien spécifiée dans la collecte des prix.

Tableau 7- Protocole pour le système d'information sur les prix de Hanoi

Nature des données	Prix de gros, prix de détail
Fréquence	Tous les jours
Produits	Légumes = tomate (locale + importée), chou (local + importé), Choy sum; Chou chinois; kangkong; courge cireuse; haricot vert; aubergine; concombre; eryngium Critères de qualité moyenne définis pour chaque légume
Marchés	Prix de gros: Long Bien, Den Lu, Dich Vong Prix de détail : Thang Cong (prix intermédiaires entre Mo, marché populaire, et 19-12, marché de clientèle aisée); Cuu Viet (marché péri-urbain)
Méthode de collecte	Collecte par 3 commerçants contact dans chaque marché A 4 a.m. pour les marches de gros et 9 a.m. pour les marchés de détail
Méthode de diffusion des données entre les commerçants et le RIFAV	Téléphone
Base de données	Excel et Oracle (ICARD)
Méthode de diffusion du RIFAV à l'ICARD et DA	Transfert par internet (le même jour que la collecte) des tableaux avec les prix et des commentaires simples sur les tendances : ↗ ↘ et pourquoi
Méthode de diffusion aux agriculteurs et agents de développement	- Transfert par fax/internet de l'ICARD à la télévision et de l'ICARD à DA, et de DA aux agriculteurs des sites du projet (le même jour que la collecte). - Diffusion par trois bulletins de marché (un pour la saison des pluies 2004, un pour l'hiver 2005, un pour la saison des pluies 2005)

Figure 5- Réseau de collecte et de diffusion des prix à Hanoi



Une enquête sur l'impact du système d'information sur les prix a été menée en mars 2006. Elle a porté sur 100 acteurs de la filière : 84 agriculteurs (dont 60 dans les sites du projet), 5 grossistes et 11 collecteurs. Les questions ont porté sur l'accès aux informations sur les prix et sur leur utilisation.

III. Promotion de la qualité sanitaire

Les travaux sur la promotion de la qualité sanitaire des légumes au Vietnam se sont déroulés selon les étapes suivantes :

- Analyse de la demande des consommateurs pour la qualité sanitaire et la signalisation de cette qualité (cf Tableau 2) ;

- analyse de l'organisation des filières en réponse à la demande de qualité, en particulier les filières « légumes propres » et « biologiques » ;

- atelier de concertation entre producteurs, commerçants et consommateurs sur la gestion de la qualité sanitaire à Hanoi ; mise en évidence de deux goulets d'étranglement : la communication aux consommateurs sur les efforts de qualité des producteurs, et le contrôle de qualité ;

- actions de communication aux consommateurs par les médias (télévision, journaux) ;

- recherche-action avec une coopérative de légumes propres sur l'amélioration de la communication aux consommateurs (matériel de communication, labellisation des produits) et le contrôle de qualité.

Dans un contexte de très forte dispersion de la production, il est plus réaliste et efficace de promouvoir les efforts de qualité des producteurs que de chercher à contrôler et sanctionner tous les producteurs qui ne respectent pas les normes de qualité. La combinaison de contrôle sur les produits avec le contrôle sur les pratiques de production est également recommandée. Avec l'accord des producteurs, des contrôles inopinés ont porté sur 124 échantillons de légumes dans la commune de Dong Du (en Août, Novembre 2004, et en Juin et Août 2005), et 15 dans la commune de Van Noi en juin 2005. Les échantillons ont été analysés par le test rapide (utilisé par le Taiwan Agricultural Research Institute), qui détermine les excès de résidus d'organophosphorés et carbamate, les pesticides les plus dangereux. Par ailleurs, des prélèvements sur les différents points de vente à Hanoi ont été réalisés sur 250 échantillons et les résidus de pesticides ont été analysés avec le test rapide et la chromatographie en phase gazeuse dans le cas de détection de résidus en excès.

Principaux résultats

I. Des consommateurs attachés à la diversité des produits frais

Les enquêtes supervisées par l'AVRDC confirment l'importance des légumes dans la consommation des habitants de Hanoi : 92 kg par habitant et par an dans la province de Hanoi (98 kg dans les districts urbains), bien supérieure à la recommandation de la FAO d'un minimum de 75 kg/habitant et par an. Les légumes-feuilles dominent la consommation (52% des quantités). En saison des pluies, le total des quantités de légumes consommés diminue (de 11% par rapport à la moyenne) et les dépenses augmentent (de 6%), la baisse des légumes-racines, des choux et des légumes-fruits est en partie compensée par l'augmentation de la consommation de légumes-feuilles[45].

A Vientiane, la consommation est plus limitée (54 kg par habitant et par an selon les données d'Agrisud en 2002), elle est composée pour plus de la moitié de légumes-feuilles, et également de tomate et chou. A Phnom Penh, la consommation atteindrait 109 kg/habitant et par an en 2001

[45] Mubarik Ali, Nguyen The Quan, Ngo Van Nam, 2006, An analysis of food demand patterns in Hanoi: predicting the structural and qualitative changes, AVRDC Technical Bulletin n°35, 61 p.

d'après le département de l'agriculture mais cette source n'est pas validée. Le type de légumes consommé est similaire à la situation de Hanoi et Vientiane.

A Ho Chi Minh Ville, la consommation de poissons s'élève à 34 kg/habitant et par an d'après l'enquête de 2002, composé pour 15 kg de poisson de mer (maquereau, anchois, thon..), pour 14 kg par du poisson d'eau douce (poisson-serpent – acheté vivant, pangasius, tilapia rouge,..) et pour 5 kg de fruits de mer. La consommation de poisson est très sensible au prix et au niveau de revenu[46].

Pour les légumes comme pour les poissons, dans les quatre villes du projet, le mode d'approvisionnement principal en produits frais est le marché de détail de proximité (à moins de cinq cent mètres du lieu d'habitation), qui se tient souvent de manière informelle dans la rue.

II. Des flux de produits locaux et régionaux

A) L'importance de l'agriculture périurbaine dans l'approvisionnement en légumes périssables

Lorsqu'on étudie l'origine des produits sur les marchés urbains, on constate une forte distinction selon la nature des aliments – et plus particulièrement leur caractère périssable (voir Tableau 8). Les légumes-feuilles sont majoritairement apportés par des zones situées à moins de trente kilomètres du centre urbain. Ce sont le liseron d'eau, les différents types de choux et moutardes, les herbes, les salades, les oignons-feuilles. Ces légumes sont en tête des légumes consommés, avec l'oignon et la tomate. Ils sont caractérisés par leur grande fragilité : leur état de fraîcheur se détériore au bout d'une journée – or la fraîcheur est un important critère de choix pour les consommateurs, qui disposent rarement de réfrigérateurs. A Hanoi, en 2002, plus de 70% des légumes-feuilles proviennent d'un rayon de production de 30 km autour de la ville. Ainsi, 95-100 % de la laitue vient de moins de 20 km, tandis que 73-100 % du liseron d'eau est cultivé à moins de 10 km de la ville[47]. A Phnom Penh, les zones urbaines, situées à l'intérieur de la municipalité, approvisionnent tout le liseron d'eau commercialisé à Phnom Penh (ce qui correspondrait à 2,000 tonnes par an). Il s'agit principalement des districts de Dangkor et Mean Chey[48].

Tableau 8- Contribution de l'APU à l'alimentation de la ville en différents produits

Périssabilité	Légumes-feuilles	Tomate	Riz	Tous produits
	→			
Hanoi (2002-2003)	70%	0 à 75% selon la saison	56%([49])	44%([49])
Vientiane (2002)	100%	20 à 100% selon la saison	100%	
Phnom Penh (2002-2003)	100% (liseron d'eau)	0 à 50% selon la saison	7%	

[46] Le Thanh Hung, et al.,2004. Consumer Behaviour Regarding Fish in Ho Chi Minh City RIFAV, Hanoi, http://www.avrdc.org/susper, 21 p.

47 Hoang Bang An, Vagneron I. et al., 2003. Spatial and institutional organisation of the vegetable market in Hanoi. Hanoi, RIFAV, http://www.avrdc.org/susper, 75 p.

48 Sokhen C, Kanika D., et Moustier P., 2005. Vegetable market flows and chains in Phnom Penh, Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 50 p.

49 Mai Thi Phuong Anh, Ali M., Hoang Lan Anh, and To Thi Thu Ha. 2004. Urban and Peri-urban Agriculture in Hanoi: Opportunities and Constraints for Safe and Sustainable Food Production. AVRDC Technical bulletin n°32, 66 p.

Tableau 9- Typologie des légumes selon leur origine à Phnom Penh

- l'origine représente plus de 90% des flux en 2002-

Légumes de Phnom Penh	Légumes de Kandal	Légumes du Vietnam
0 à 20 kilomètres	20 to 40 kilometres	400 kilomètres
Liseron d'eau	Choysum	Tomate (*)
	Laitue	Chou
	Haricot kilomètre	Chou chinois

Tableau 10- Typologie des légumes selon leur origine à Vientiane [50]

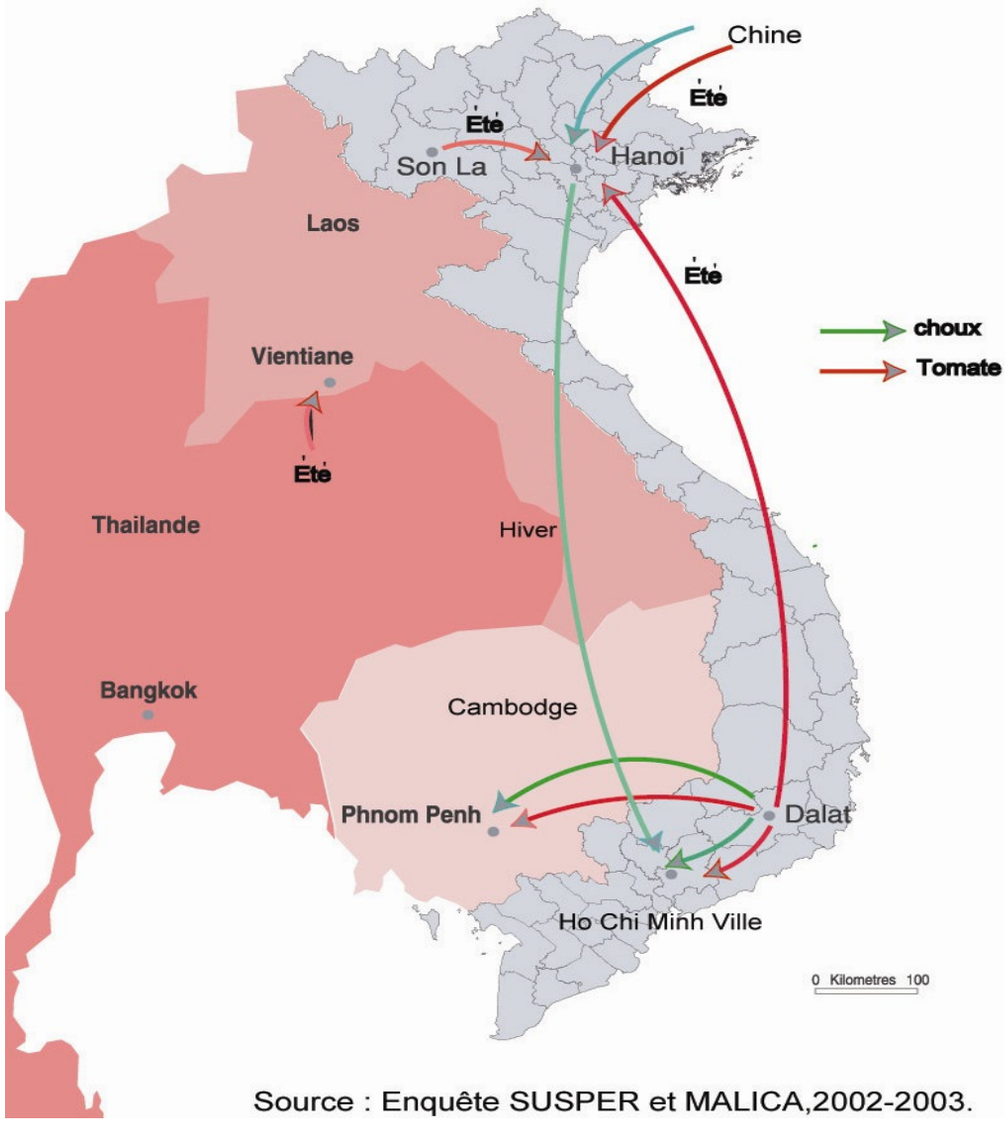
-l'origine représente plus de 90% des flux en 2002-

Légumes de Vientiane	Légumes de Thailande
0 à 30 kilomètres	30 à 500 kilomètres
Liseron d'eau	Tomate, kale et concombre (entre Juillet et Septembre)
Pakchoi	
Moutarde chinoise	
Laitue	
Aubergine	

Pour les légumes moins périssables comme la tomate et le chou, qui peuvent se conserver sans dégradation pendant quelques jours, les flux se partagent entre zones périurbaines et zones rurales. En effet, les légumes tempérés sont sensibles aux variations climatiques. En saison des pluies, c'est moins la distance que la sensibilité de la zone à la pluviométrie et à la température qui explique les zones d'approvisionnement. L'agriculture périurbaine, à certaines périodes de l'année, ne permet pas de couvrir les besoins des consommateurs, ce qui se reflète par des fortes hausses de prix et des importations. Le complément par l'agriculture rurale est alors crucial, d'autant plus que l'agriculture rurale peut avoir des avantages comparatifs spécifiques de production à certaines périodes. Au Vietnam, les zones périurbaines ont un faible potentiel de production en saison des pluies, du fait des températures élevées et des précipitations qui favorisent les dégâts physiques et les maladies. Ce sont alors des zones de montagne, situées en Chine, à Dalat et à Son La qui prennent le relais de la production locale. Alors que 75 % des tomates sont cultivées à moins de 30 km de Hanoi pendant la saison froide, 80 % des tomates vendues en saison chaude viennent de Chine et 15 % de Dalat, située à plus de 1,000 km au sud de Hanoi (voir Carte 1).

[50] Somsack Kethongsa, Khamthanh Thadavong, et Paule Moustier, 2004. Vegetable Marketing in Vientiane (Lao P.D.R.). Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 56 p.

Carte 1- Flux régionaux de légumes



Source : Enquête SUSPER et MALICA,2002-2003.

Des filières courtes

A Hanoi, plus de 40% des vendeurs sur les marchés de gros sont des producteurs ; ce pourcentage atteint 100% dans le cas du liseron d'eau. Les producteurs transportent de 100 à 200 kilos par jour sur les marchés de gros sur des vélos ou mobylettes surchargés. Les productions périurbaines sont transportées sur de courtes distances, avec des moyens de transport souvent non motorisés (à pied ou en deux-roues). Cette caractéristique est positive en termes de coût final du produit, et également d'impact sur l'environnement. Ainsi, à Hanoi, toutes les productions périurbaines sont acheminées par deux-roues (vélo ou moto), alors que les produits de Chine et de Dalat sont transportées par camion. Le liseron d'eau, qui est produit dans des jardins situés à moins de vingt kilomètres de la ville, est transporté à vélo pour plus de 90% des transactions.

A Phnom Penh, 57% des détaillants de liseron d'eau sont directement approvisionnées par des agriculteurs.

Filière courte de légumes périurbains
Paysan→(Collecteur) →Détaillant →Consommateur

Pour les productions rurales, le stade de grossiste/collecteur est beaucoup plus systématique. Au Vietnam, le stade de grossiste ou de collecteur existe pour plus de 70% des transactions portant sur des produits d'origine rurale.

Filière longue de légumes ruraux
Paysan → Grossiste collecteur → Grossiste distributeur → Détaillant → Consommateur

A Vientiane, malgré la faible distance entre les zones de production et les marchés, les chaînes de vente sont caractérisées par une certaine complexité. On observe la fréquente combinaison des fonctions de gros et de détail, de collecte et de gros (pour plus de la moitié des commerçants). Plus de 65% des quantités commercialisées passent par un stade intermédiaire entre le producteur et le détaillant, même pour un légume périssable comme le liseron d'eau. Ceci peut s'expliquer par l'absence d'un lieu spécifique pour la vente en gros, qui a lieu au même endroit que la vente au détail, et aussi par les faibles volumes mis en marché (moins de 200 kg/jour pour les grossistes comme pour les détaillants), et les modes de transport (le tuktuk est le moyen dominant).

1.1. L'avantage de la proximité: la fraîcheur

A Hanoi, la fraîcheur est l'avantage de la production de légumes citée par 74% des 500 ménages interrogés en 2003. A Vientiane, la fraîcheur est le critère de choix des légumes cité par le plus grand nombre de consommateurs (71% parmi 100 consommateurs interrogés en 1999)51.

1.2. L'avantage de la proximité : les faibles marges

Les travaux de l'université agricole de Hanoi (1998) évaluent la marge commerciale à 30 % sur les légumes-feuilles, à 35 % pour le chou et à 75 % pour la tomate[52]. Les études de cas du CIRAD-VASI (2002) identifient des marges de 45-50 % sur le chou[53]. Ces données doivent être prises avec prudence étant données les fortes variations des prix au cours de l'année. Dans les flux de longue distance, les revenus des grossistes sont plus de dix fois supérieurs à ceux des producteurs, détaillants ou collecteurs, mais les risques de faillite sont également beaucoup plus élevés, du fait de l'irrégularité de la production et du manque de structures d'arbitrage en cas de conflit.

A Phnom Penh, les agriculteurs urbains qui vendent le liseron d'eau aux détaillants reçoivent plus de 50% du prix final[54] alors que les producteurs de tomate de Kandal (districts de Mukh Kandal et Khsach Kandal), situés entre dix et vingt kilomètres de Phnom Penh, et qui vendent aux collecteurs, reçoivent 30% du prix final[55].

L'importance et les déterminants du commerce régional (cas de la tomate)

Entre le Vietnam et la Chine

Selon les informations collectées auprès des douanes et des commerçants du marché de Long Bien, les importations de légumes frais en provenance de la Chine à destination de Hanoi représenteraient environ 9,000 tonnes[56], principalement composées de tomate (3500 tonnes[57]), de

[51] Potutan G. E., Sanatem K., Janubas L. G, Holmer R. J., Schnitzler W. H., 1999. The status of vegetable consumption, production and marketing in Vientiane. Cgayan de Oro, Xavier University College of Agriculture, Periurban Vegetable Production Project, 84 p. + app.

[52] Bui Thi Gia, 1999. Vegetable production and marketing in Hanoi. In: Hanoi Agricultural University and HAU-JICA ERCB project, Agricultural products marketing in Japan and Vietnam, proceedings of the first joint workshop at faculty of economics and rural development, pp. 37-47.

[53] Ho Thanh Son, Bui Thi Thai et Moustier P., 2003. Strategies of stakeholders in vegetable commodity chain supplying Hanoi market. Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 50 p.

[54] Sipana C. and Moustier P., 2005. Socio-economic strategies and results of vegetable traders in Phnom Penh (Cambodia), Hanoi, RIFAV, CIRAD, http://www.avrdc.org/susper, 45 p.

[55] Sokhen C. and Centmill M.. Tomato chain study in Phnom Penh. Internal document, Hanoi, CIRAD, 11 p.

[56] Le total des légumes importés de Chine (y compris pomme de terre et oignon), étant d'environ 94,000 tonnes.

[57] Les exportations totales de tomate de Chine vers le Vietnam seraient de 4754 tonnes en 2004 (Gain Report, 2005 – voir nbp 5.

chou (2700 tonnes), le reste incluant la carotte, le chou chinois, divers types de moutarde. Ces importations ont lieu entre les mois de mai et d'octobre. Elles représenteraient environ 9% du total de légumes frais consommés à Hanoi[58].

La Chine est le premier producteur mondial de tomate, avec 35 millions de tonnes en 2005/2006 (33 Mt en 2003)[59]. La région de production de la tomate de Chine exportée au Vietnam est le Yunnan (région de Kunming). En 2003, la production de tomate du Yunnan serait de 254,000 tonnes, sur une surface de 9,400 hectares.

La comparaison de la production de tomate au Vietnam (Ha Tay) et en Chine (province de Kunming, district de Tran Con, commune de Tan Thach) montre les différences suivantes (voir Tableau 11 et Figure 6)[60] :

- surfaces supérieures en Chine (2,232 m² au total, au lieu de 1,530 m² au Vietnam; dont 1,340 m² pour la tomate, au lieu de 670 m² au Vietnam)

- rendement supérieur en Chine (117 t/ha au lieu de 61 t/ha), grâce à une température et une pluviométrie plus faible au stade de la floraison, ainsi qu'une variété à plus haut rendement. Tous les producteurs vietnamiens interrogés donnent le climat comme leur difficulté principale de production, les fortes pluies abîment les fruits. Et le district de Thuong Tin était le seul à produire de la tomate au moment de l'enquête. En Chine, cinq des producteurs interrogés mentionnent les difficultés de commercialisation, difficultés à trouver des acheteurs et faible prix ; deux mentionnent que les faibles températures entraînent des coûts de production élevés, car elles allongent le temps de la récolte (un mois au Vietnam, deux mois en Chine) et aussi le temps de la pépinière (deux mois en Chine, quelques semaines au Vietnam) ;

- Calendrier de production plus long en Chine : au Vietnam, le mois de juin correspond au dernier mois de récolte (pour un semis au mois de janvier, un repiquage 45 jours après, la récolte commençant 3 mois après et durant 25-30 jours) ; en Chine, le semis a lieu en novembre ou en décembre (l'hiver est plus froid en Chine et le temps de développement est plus long), le début de la récolte a lieu début mai et la fin, fin juin. Dans d'autres villages que le village enquêté, les producteurs commencent le semis plus tard (entre novembre et janvier) et peuvent récolter dans la période entre avril et octobre. Les collecteurs commandent les tomates à différents mois de l'année auprès des producteurs des différents villages pour bénéficier d'une offre étalée entre mai et octobre. Les faibles températures rendent difficile la production de tomate (surtout la maturation) entre novembre et avril.

- Les variétés de tomate : en Chine, il s'agit de la variété TF415 (variété hybride produite en Chine, ovale, de 70-80 grammes), et au Vietnam des variétés VL2000 (variété hybride produite au Vietnam, ronde, 100g) ou VL2910 (variété hybride du Vietnam, semblable à la TF 415 de Chine).

- Qualité : la tomate de Chine a une couleur plus prononcée, elle est plus ferme et plus facile à transporter que la tomate produite au Vietnam.

Le coût de production par unité de surface est deux fois supérieur en Chine, mais comme le rendement est deux fois plus élevé, le coût de production par kilo est équivalent. C'est le coût de travail, le coût d'engrais et les autres coûts (comme les tuteurs) qui sont supérieurs en Chine. Les coûts des semences et insecticides sont moins élevés : d'une part, les industries de fabrication d'intrants agricoles sont plus présentes en Chine ; d'autre part, les producteurs surveillent les maladies et ramassent des insectes à la main. Par ailleurs, le prix au producteur est deux fois plus faible en Chine, mais comme le rendement est deux fois plus élevé, le profit du producteur est équivalent.

[58] Avec les données de l'AVRDC de 76 kg de légumes frais consommés par habitant et par an (soit 98 kg moins 22 kg de légumes secs comme les alliums et les pommes de terre), une population de 1.5 millions d'habitants dans les districts urbains de Hanoi en 2002, et en déduisant 13% de consommation hors domicile et 1% d'auto-approvisionnement (production et dons).

[59] Les informations qui suivent sont tirées de : Gain Report, 2005. China, Peoples Republic of Tomatoes and Products Situation, USDA Foreign Agricultural Service, 16 p., www.fas.usda.gov/gainfiles/2004 et 2005, 13 p.

[60] Ces informations sont tirées de Vu Thi Tinh, report on tomato production in China and Vietnam, 2006, internal document, RIFAV.

Tableau 11- Distribution des coûts et prix dans les filières de la tomate du Vietnam et de la Chine à destination de Hanoi en juin 2005

Note – 1 sao = 360 m²

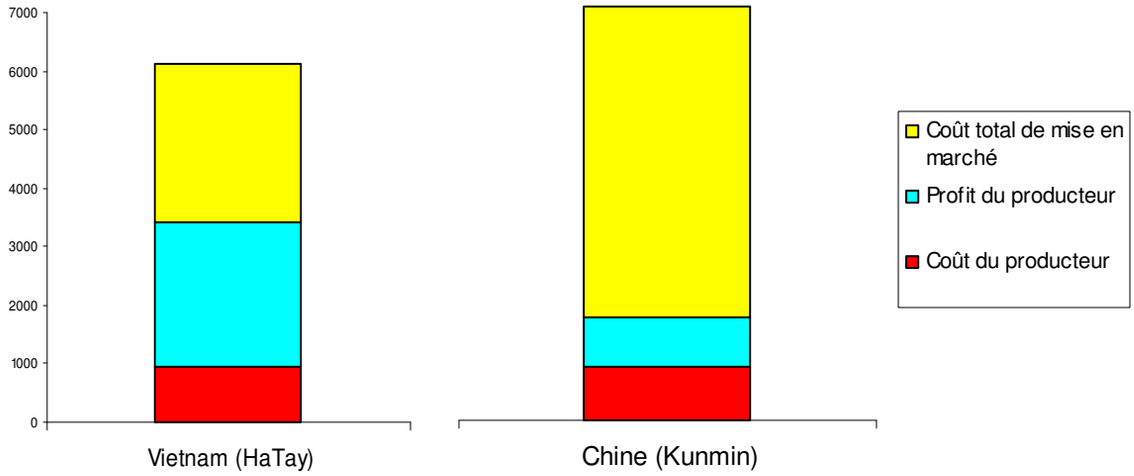
	VIETNAM		CHINE	
	VND/kilo	VND/sao	VND/kilo	VND/sao
Coût de main-d'oeuvre	289	583,216	373	1,572,008
Coût de pesticide	232	469,656	110	465,405
Coût d'engrais	224	451,784	192	810,894
Coût de semences	55	110,396	17	71,547
Autres coûts	138	279,357	181	758,368
Coût de production total	938	1,894,409	873	3,678,223
Profit du producteur	2462	4,232,370	827	2,396,179
Prix au producteur	3400	6,126,784	1700	6,074,402
Coût total de mise en marché	2725		5175	
Prix de détail	6125		6875	
Coût du collecteur	147			
Profit du collecteur	953			
Coût du détaillant	654			
Profit du détaillant	971			
Marge du collecteur à la ferme			408	
Coût du collecteur transfrontalier			458	
Profit du collecteur transfrontalier			492	
Coût du grossiste collecteur			474	
Profit du grossiste collecteur			593	
Coût du grossiste distributeur			169	
Profit du grossiste distributeur			831	
Coût du détaillant			821	
Profit du détaillant			929	

Pour les tomates de Chine, les coûts de mise en marché sont logiquement supérieurs à ceux de la tomate du Vietnam, surtout du fait de différences dans les coûts de transport (189 VND/kilo pour la tomate du Vietnam, 612 VND/kilo pour la tomate de Chine), des intermédiaires plus nombreux (4 au lieu de 2 entre producteur et détaillant), et aussi des taxes plus élevées (10 VND/kilo pour le collecteur vietnamien, 230 VND/kilo pour le collecteur transfrontalier). Les coûts des détaillants sont supérieurs car il s'agit de détaillants vendant dans des marchés à la clientèle plus aisée, donc avec des frais de location et taxes supérieurs.

Les trois commerçants interrogés vendant les tomates des deux origines indiquent que la tomate de Chine a un aspect plus uniforme, et se conserve plus longtemps.

Dans les deux types de filières, les relations entre les acteurs sont régulières.

Figure 6- Distribution des coûts et prix dans les filières de la tomate du Vietnam et de la Chine à destination de Hanoi en juin 2005 (en équivalent VND/kilo)



Entre le Cambodge et le Vietnam

A Phnom Penh, pour les huit légumes sélectionnés, qui représentent environ 40% du total consommé, le tonnage vendu est de 32,800 tonnes, dont 12,800 sont importés (soit 39%) et 16,400 tonnes (61%) sont locaux.

La comparaison de la production de tomate au Cambodge (province de Kandal) et au Vietnam (Dalat) montre les différences suivantes[61] :

- Surface : 5,800 m² de tomate en moyenne au Cambodge (36% de la surface totale).

- Calendrier de production : au Cambodge, la production de tomate a lieu principalement en saison sèche, de novembre à avril – en fin de saison sèche, de janvier à avril, la production est difficile, ainsi qu'en saison des pluies (Mai à Octobre). En fin de saison sèche, de la tomate est produite dans les districts de Kien Svay, Mukh Kandal et Khsach Kandal du fait de la proximité de points d'eau.

A Dalat, la saison principale de production est d'octobre à avril.

Rendement : le rendement est en moyenne de 8 tonnes/hectare au Cambodge – le minimum est de 6.5 et le maximum de 22.7 tonnes : ce maximum est atteint avec une utilisation plus importante d'engrais et de pesticides plus coûteux.

A Dalat, le rendement est de 175 tonnes par hectare pour un producteur interrogé. Le coût de production est de 73,500,000 VND/ha. Les tomates sont acheminées tout d'abord à Ho Chi Minh Ville, puis de Ho Chi Minh Ville à la frontière par des collecteurs, les tomates sont livrées aux grossistes de Phnom Penh.

Au Cambodge, les coûts de main-d'œuvre comprennent les coûts de désherbage, labour, récolte, payés comme prestations de service – L'amortissement concerne surtout les pulvérisateurs (7/10 producteurs en possèdent) et les motopompes (2/10 producteurs) –

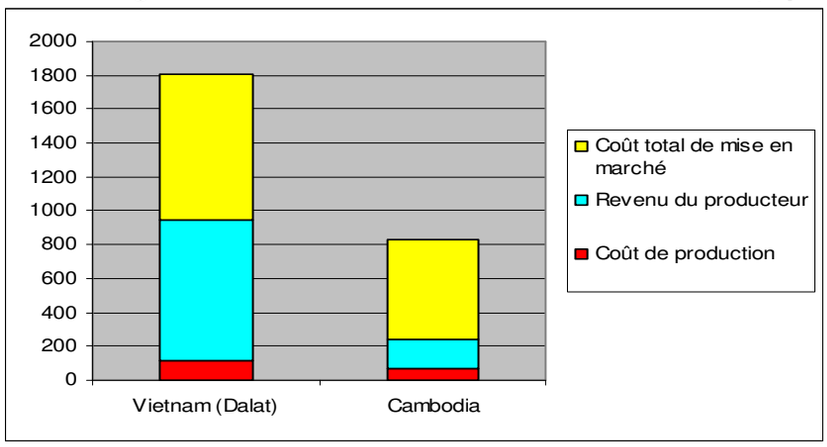
La décomposition des coûts et prix dans les filières en provenance du Cambodge et du Vietnam est présentée dans le Tableau 12 et la Figure 3.

[61] Chhean Sokhen et Meach Centmil. 2006. Tomato chain study in Cambodia. Susper internal document, 6 p.; les données sur la filière tomate à Dalat ont été collectées par Boun-Tieng Ly.

Tableau 12- Distribution des coûts et prix dans les filières de la tomate du Cambodge et du Vietnam à destination de Phnom Penh en mars 2006 (en équivalent Riels/kilo)

	CAMBODGE	VIETNAM
	Riels/kilo	Riels/kilo
Coût de main-d'oeuvre	28	
Coût de pesticide	4	
Coût d'engrais	8	
Coût de semences	3	
Amortissement des équipements	17	
Autres coûts	4	
Coût de production total	64	116
Profit du producteur	173	834
Prix au producteur	237	950
Coût total de mise en marché	591	855
Prix de détail	828	1805
Coût du collecteur	85	100
Profit du collecteur	82	
Coût du grossiste	42	350
Profit du grossiste	83	
Coût du détaillant	93	131
Profit du détaillant	206	149

Figure 7- Distribution des coûts et prix dans les filières de la tomate du Vietnam et du Cambodge à destination de Phnom Penh en mars 2006 (equivalent en riels/kilo)



Dans les deux types de filières, les relations entre les acteurs sont régulières.

Les systèmes d'information et de concertation sur les marchés

Le fonctionnement du système d'information a été présenté en détail dans la partie méthodologique. Les principaux résultats sur l'utilisation et l'impact du système sont résumés ci-dessous[62].

Au cours des deux premières années du projet, nous avons aidé les agriculteurs, ainsi que les cadres de la recherche et du développement, dans les décisions de moyen terme sur le choix des

[62] Hoang Bang An et Moustier P., 2006. Vegetable market information and consultation systems in the Mekong region. RIFAV, Hanoi, http://www.avrdc.org/susper, 191 p.

sites, des cultures, et des périodes de l'année. Nous avons contribué à la sélection des sites du projet en tenant compte de leur importance et leur continuité dans l'approvisionnement alimentaire de la ville :

1. A Hanoi, la commune de Dong Du (district de Gia Lam), pour l'approvisionnement en légumes aromatiques et en chou ; Tien Phong (Me Linh) pour l'approvisionnement en tomate de novembre jusqu'en juin, Tien Duong (Dong Anh) pour l'approvisionnement en tomate et choysum, Vo Cuong (Bac Ninh) pour la tomate[63].
2. Pour Phnom Penh, les districts de Kien Svay et de Saang dans la province de Kandal, pour l'ensemble des légumes.
3. A Vientiane, le district de Sikhotabong, avec une production diversifiée de légumes-feuilles et de légumes-fruits.

Alors que les maraîchers considéraient que les importations des pays voisins étaient un frein au développement de la production locale, les ateliers de concertation dans les trois pays ont permis d'atteindre un consensus entre un panel de producteurs, commerçants, et agents de recherche, sur la possibilité pour la production locale de se substituer aux importations : (i) en ciblant des produits spécifiques, comme la tomate dans les trois pays, à certaines périodes de l'année (surtout la saison des pluies, entre juin et novembre) ; (ii) en appliquant des techniques de production en contre-saison, comme la production de tomate greffée, avec des variétés résistantes au flétrissement bactérien ; (iii) en adaptant la qualité visuelle des légumes à la demande des consommateurs, par exemple, en produisant un chou de petite taille à Hanoi, semblable au chou importé de Chine. Des stratégies de diversification ont également été discutées à Vientiane, comme la production de chou chinois en saison sèche, et de menthe et d'aubergine en début de saison des pluies[64].

Dans les ateliers de concertation organisés à Hanoi et à Phnom Penh, la demande des producteurs pour une information journalière sur les prix de gros et de détail est apparue prioritaire, avec une diffusion par la télévision au Vietnam, et par radio au Cambodge. Cette information est jugée utile par les producteurs pour mieux cibler les périodes de prix élevés et mieux négocier avec les commerçants. L'échange des légumes est caractérisé par une combinaison d'interactions occasionnelles et de relations régulières, sans engagements rigides sur les conditions de prix et de quantités. Donc la marge de manœuvre pour utiliser des informations sur les prix dans les négociations avec les commerçants est assez grande.

L'enquête d'impact montre qu'une majorité (74%) d'agriculteurs et de commerçants ont accès à l'information sur les prix de Susper par la télévision. Ils écoutent l'émission de télévision sur les prix tous les jours (62%) ou plusieurs fois par semaine (25%). L'information est surtout utilisée pour la négociation des prix avec les acheteurs, ainsi que le choix des cultures. Les acteurs qui n'utilisent pas l'information sur les prix sont caractérisés par une faible surface de production (moins de 700 m²) et des relations régulières avec les acheteurs.

D'après l'ICARD, le ministère de l'agriculture pourra financer la collecte et diffusion des prix de gros et de détail des légumes en 2007.

A Phnom Penh, les agriculteurs interrogés ont déclaré qu'ils ont besoin d'une information journalière sur les prix des légumes par la radio. Cette diffusion est déjà mise en œuvre par le bureau de commercialisation agricole du ministère de l'agriculture, mais elle est peu connue des agriculteurs, et la fiabilité de l'information collectée doit être améliorée, en particulier en ce qui concerne l'homogénéité de la qualité des produits sur lesquels les prix sont relevés.

[63] Mai Thi Phuong Anh, Nguyen Thi Tan Loc, Le Nhu Thinh, Ho Thanh Son et Moustier P., 2004. Basic information on the project sites in Hanoi peri-urban areas, http://www.avrdc.org/susper, 24 p.

[64] Jean-François Lecoq, 2003, Negotiation Tools for the Commodity Chain in Vientiane, RIFAV, Hanoi, http://www.avrdc.org/susper, 23 p.

III. Promotion de la qualité sanitaire

Diagnostic de l'offre et de la demande en qualité sanitaire

Une demande croissante de qualité sanitaire

Pour 90% des 200 ménages de Hanoi, la qualité sanitaire des légumes a baissé au cours des dix dernières années[65]. Ils considèrent que les légumes sont les plus préoccupants en termes de santé, principalement à cause des pesticides. A Phnom Penh et à Vientiane, les commerçants interrogés déclarent préférer acheter des produits locaux aux produits importés parce que ceux-ci sont réputés plus sains (avec moins de traitements chimiques) et donc plus facilement achetés par les consommateurs.

Des contaminations effectives

A Hanoi, des pesticides interdits comme le Wotafox (Méthyl Parathion) ou le Monitor (Méthamidophos) ont été repérés comme utilisés par des agriculteurs du district de Tu Liem. Diverses analyses d'échantillons de légumes dans des coopératives périurbaines menées entre 1994 et 1995 ont montré des excès de nitrates et de pesticides par rapport aux normes autorisées[66].

En 2004, des tests rapides menés par Susper sur 25 échantillons de légumes dans les marchés de détail de Phnom Penh, et 30 dans les marchés de détail de Vientiane, ont montré des excès de résidus de pesticide sur des échantillons de chou importé du Vietnam et sur le chou-feuille périurbain (à Phnom Penh), ainsi que sur le chou chinois importé de Thailande au Laos.

A Hanoi, les analyses menées par Susper en 2006 sur divers points de vente au détail ont montré que sur 250 échantillons, 9% avaient des résidus de pesticides supérieurs aux normes, il s'agit surtout de divers choux-feuille d'origine périurbaine[67].

A Phnom Penh, des analyses de métaux lourds dans le liseron d'eau cultivé au Boeng Ansaong Andaet, un étang où se déversent les eaux usées au Sud de Phnom Penh, ont été réalisées par le projet Susper (envoi des échantillons au laboratoire de l'université agricole de Ho Chi Minh Ville). Les analyses ont révélé des résidus de zinc en quantité plus de huit fois supérieure à la norme FAO[68].

En 2003, des analyses réalisées sur des poissons cultivés autour de Ho Chi Minh Ville ont montré des excès d'arsenic au village de An Lac, situé dans une zone industrielle et de zinc, pour les carpes et le tilapia (Hung, infra).

Les difficultés de reconnaissance de la qualité

En 1995, l'intérêt public pour la question de la qualité sanitaire des légumes a conduit le gouvernement vietnamien à conduire un ambitieux programme appelé « légumes propres ». Ce programme couvrait en 2001 30% de la surface cultivée en légumes autour de Hanoi (2250 hectares). Il comprenait des formations à l'usage raisonné des engrais, des pesticides et de l'eau. Des certificats de production ont été délivrés par le département des sciences et technologies de la ville de Hanoi aux coopératives impliquées dans ce programme. Enfin, un réseau de magasins « légumes propres » a été établi pour la distribution des légumes produits par ces coopératives. En parallèle, la production de légumes biologiques a démarré en 1999 à l'initiative d'une ONG (CIDSE).

Les producteurs vendant leurs légumes sous le signe « légumes propres » ou biologiques peuvent obtenir des revenus supérieurs de 50 à 100% par rapport à la production conventionnelle (Son,

[65] Muriel Figuié, 2003. Vegetable Consumption Behaviour in Vietnam. Hanoi, CIRAD, http://www.avrdc.org/susper, 23 p.

[66] Tran Khac Thi 1999. Study on some environmental factors and solutions on safe vegetable development. Paper presented at National workshop on safe and year round vegetable production in peri-urban areas, CIRAD/RIFAV Hanoi, 15-16 December, pp. 33-47. Malheureusement, la méthode de collecte et d'analyse des échantillons, ainsi que le pourcentage d'échantillons avec excès de résidus, ne sont pas présentés de manière précise.

[67] Nguyen Kim Chien et Paule Moustier, 2006. Vegetable Pesticide Residues in Selected Fields and Points of Sale. Internal Susper document.

[68] Document interne réalisé par Boun-Tieng Ly.

Hung Anh et Moustier, infra). Cependant, la part des légumes vendus comme « légumes propres » ou « légumes biologiques » représentait environ 2200 tonnes en 2002 (dont une quarantaine seulement pour les légumes biologiques), soit moins de 5% de la consommation des ménages de la capitale, et moins de 2% de la production de la province de Hanoi. Ainsi, les producteurs faisant de réels efforts de qualité sont mal reconnus sur le marché. Par ailleurs, le contrôle de qualité sanitaire est difficile à organiser. D'une part, la production autour de Hanoi est très dispersée : plus de 100 000 producteurs, sur des surfaces de moins de 1000 m². D'autre part, les laboratoires d'analyse publics sont multiples et concurrents. Enfin, le coût de l'analyse est très élevé (20 USD par échantillon pour la chromatographie en phase gazeuse).

L'organisation des filières de qualité

Les supermarchés qui souhaitent s'approvisionner en produits de qualité spécifiée font appel à des filières plus intégrées que celles qui approvisionnent les détaillantes sur étal. Ainsi, à Hanoi, les supermarchés, magasins, écoles et restaurants sont approvisionnés directement par un petit nombre de coopératives (principalement trois en 2003, représentant en tout une trentaine d'hectares), avec lesquelles ils entretiennent des relations de fidélisation. Ces coopératives bénéficient de l'appui technique des programmes « légumes propres » des services de l'agriculture de la province de Hanoi (pratiques d'agriculture raisonnée) et d'un certificat délivré par le département des sciences et technologies (mais obsolète depuis 2001, et progressivement remis en place par le département de la protection des végétaux depuis 2004)[69]. La proximité entre les zones de production et les marchés permet aux producteurs de vendre directement au détail aux consommateurs, ce qui représente une forme intéressante de garantie de la qualité, par les échanges d'information et la confiance développée entre les producteurs et les consommateurs (voir dans la partie 2 les cas de la coopérative de Van Tri et de la coopérative de Dong Du).

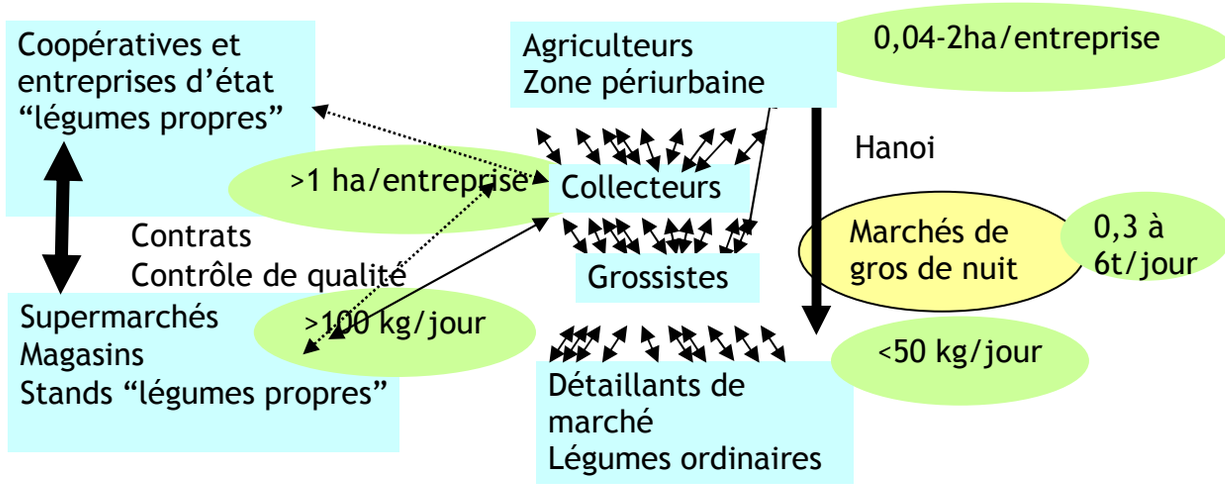
La filière des légumes biologiques s'est développée à l'initiative d'une organisation non gouvernementale (CIDSE) et concerne actuellement une trentaine de familles dans la province de Hanoi (Tu Liem) et de Ha Tay (Chuong My). Jusqu'à 2004, l'ONG concluait des contrats avec les producteurs d'une durée de trois mois à des prix et quantités fixés ; elle leur fournissait engrais organiques et formation technique. Les producteurs ayant des difficultés à trouver des débouchés, l'ONG s'est aussi impliquée dans la commercialisation au détail, en appuyant la mise en place d'une compagnie privée (compagnie Hanoi Organics) qui a ouvert un magasin et livre aux particuliers. La filière de légumes « propres » de Dalat dispose d'une organisation similaire. Elle est pilotée par la société Golden Garden Company, liée par contrat à l'association des fermiers de légumes propres qui comporte 35 exploitants sur 4 hectares[70].

Il est notable que l'analyse des résidus de pesticides menée en différents points de vente en 2005 a montré un gradient depuis le magasin de légumes biologiques (pas de résidu mesuré), les magasins de légumes propres et les supermarchés (1.5% d'échantillons avec résidus), et les marches traditionnels (10% d'échantillons avec excès de résidus)(voir note de bas de page 67).

[69] Voir Moustier P., Figuié M., Nguyen Thi Tan Loc et Ho Thanh Son, 2005. The role of coordination in the safe and organic vegetable chains supplying Hanoi. 2006. In Acta Horticulturae, (699), pp. 297- 303.

[70] Dini L., 2002. La gestion de la qualité sanitaire dans la filière des légumes à Hanoi. Mémoire de master, CNEARC/CIRAD, Montpellier.

Figure 8- Organisation des filières des « légumes propres » et des « légumes ordinaires » à Hanoi



Ateliers de concertation sur la qualité

A Hanoi, deux ateliers de concertation ont porté sur les problèmes de qualité sanitaire dans les filières des légumes. Le premier a été organisé le 17 juin 2003 au Rifav. Il a rassemblé six responsables de coopératives (dont 2 de légumes propres et trois de 3 sites du projet), 4 collecteurs des sites du projet, trois détaillants (un de légumes propres, un de légumes biologiques, un détaillant de marché ordinaire), deux représentants de l'association des consommateurs, trois journalistes, trois représentants de l'administration et dix chercheurs. Cet atelier a permis de faire un bilan sur la situation de l'offre et de la demande de qualité sanitaire à partir des résultats de Susper. Un consensus s'est dégagé autour de deux priorités pour améliorer cette adéquation : (i) la communication sur les efforts de qualité des producteurs ; (ii) le contrôle de la qualité sanitaire. Chacun de ces thèmes a fait l'objet de groupes de travail qui ont donné des recommandations[71] :

(i) la communication sur les efforts de qualité des producteurs : information des consommateurs sur l'origine des légumes, les points de vente, les caractéristiques de qualité sanitaire

(i) le contrôle de la qualité sanitaire : ce contrôle doit être à faible coût et flexible, s'appuyant sur le contrôle interne à l'intérieur des coopératives ; la vente directe des légumes par les consommateurs permet aussi un contrôle plus facile des consommateurs sur les conditions de production.

Un deuxième atelier a été organisé dans un site du projet, à Dong Du, le 20 octobre 2003. La réunion a rassemblé 64 producteurs, 2 représentants de la coopérative, 3 représentants de la commune, un collecteur de légumes de Dong Du, une responsable de magasin « légumes propres », et une responsable de supermarchés, des responsables du projet IPM de ADDA, 9 chercheurs. Au cours de cette réunion, la situation de production de « légumes propres » de Dong Du a été présentée, ainsi que les difficultés des commerçants et consommateurs à trouver un approvisionnement régulier en « légumes propres ». Les commerçants s'approvisionnent surtout à Van Noi et cherchent à diversifier leur approvisionnement. Les producteurs ont été informés des points de vente possibles pour les « légumes propres », et des demandes des consommateurs et

[71] Une synthèse de cet atelier a été rédigée pour la revue des consommateurs : Nguyen Thi Tan Loc, Muriel Figuié et Paule Moustier, 2003, Gap go giua cac nha san xuat, buon ban va tieu dung voi cac nha nghien cuu rau (Meeting between farmers, traders, consumers and researchers on vegetables), Nguoi Tieu Dung n° 137, p. 1.

commerçants en termes d'étiquetage, et de certificat de qualité. Les producteurs de Dong Du préfèrent la vente directe aux consommateurs, et les contrats avec les restaurants, plutôt que la vente aux commerçants, car ils craignent de ne pouvoir répondre aux exigences de diversité et de régularité des commerçants.

Etat des lieux de la promotion de la qualité pour deux coopératives de légumes propres : Dong Du et Van Noi

Deux communes de production de légumes propres ont été plus particulièrement choisies pour les actions de promotion de la qualité sanitaire: Dong Du (dans le district de Gia Lam) et Van Noi (dans le district de Dong Anh). Elles font partie des trente trois communes du programme « légumes propres » de 1996. Nous avons choisi des coopératives déjà impliquées dans l'application de cahiers de charge « légumes propres », afin d'améliorer la rigueur dans les pratiques de contrôle de qualité.

Un état des lieux a d'abord été réalisé sur la situation de production et de mise en marché dans les deux communes[72].

A Dong Du

La production de "légumes sains" couvre 30 hectares de légumes en été (40 hectares en hiver), et 70 foyers organisés en 5 groupes. La production totale annuelle de ces groupes est estimée par la coopérative à 1900 tonnes environ, d'une valeur de 5 milliards de VND par an (310,000 dollars). De 2001 à 2002, l'ONG ADDA a organisé des classes sur la production de légumes sains (12 cours avec 30 participants par cours) – les formations précédentes, de 1996 à 2001, par les services du comité populaire, ont été d'un nombre équivalent. Les chefs de groupe déclarent effectuer des contrôles toutes les semaines dans les champs et dans les magasins de vente d'intrants, sur les pratiques d'utilisation des produits chimiques.

Le principal mode de vente des légumes est au champ par les collecteurs (pour les légumes aromatiques), ou sur les marchés de gros ou de détail des villages environnants. Une petite partie de la production est aussi vendue à travers des contrats avec trois cantines d'usine (675 kg/jour au total, soit 250 tonnes par an). En 2002, la coopération japonaise a financé la location d'un stand au marché de Hang Da, mais la coopérative n'a plus pu payer cette location par la suite, et a préféré louer un stand au marché de Gia Lam à partir de 2004. Les quantités moyennes vendues par le magasin sont de 70 kilos par jour (25 tonnes par an).

A Van Noi

La coopérative de Van Tri est un exemple intéressant d'action collective et d'intégration verticale réussies dans la filière. Elle est composée de treize membres, qui cultivent sur 3 hectares environ 100 tonnes de légumes par an. En plus de la production de ses membres, elle achète en hors-saison les légumes de producteurs de Moc Chau. Elle exerce un contrôle sur la production de Moc Chau par la location des terrains aux propriétaires, sur lesquels travaillent des agriculteurs qui sont dispensés de frais de location pendant 5 ans, et qui sont contrôlés sur le plan technique par les propriétaires. Ceux-ci en contrepartie reçoivent une commission de 5% sur la vente des légumes. En 2004, les légumes de la coopérative étaient vendus au détail à travers dix points de vente, chacun géré par un membre de la coopérative (qui achète à d'autres membres et à la coopérative de Moc Chau en complément de sa production), écoulant en moyenne 200 kilos de légumes par jour. La coopérative vend également des légumes à deux supermarchés, quatre écoles, et cinq restaurants, avec lesquels elle entretient des relations de fidélisation[73].

Des enquêtes sur les pratiques de production ont été menées auprès de 30 ménages de trois coopératives du village de Van Tri. Le type de fumier, engrais, pesticides, ainsi que les délais entre

[72] Par Nguyen Thi Tan Loc, RIFAV, pour Dong Du, et Ho Thanh Son, ASD-VASI pour Van Noi.

[73] Ho Thanh Son, 2004. Organisation de la production et de l'écoulement des produits de légumes Van Tri-Van Noi-Dong Anh-ville de Hanoi. Document interne, SUSPER, AVRDC/CIRAD, Hanoi, 11 p.

utilisation et récolte, ont été comparés aux normes, sur la base des déclarations des producteurs. Cette enquête montre un bon respect (déclaré) des normes de production, ce qui montre au moins leur bonne connaissance, si leur application ne peut être que difficilement vérifiée. Pour certains légumes cependant (comme le pois chinois) les délais de pulvérisation de pesticides avant récolte sont plus courts d'une journée par rapport aux délais recommandés, alors que ces délais sont respectés pour la tomate et le chou.

Amélioration de la communication sur les efforts de qualité (Hanoi)

En janvier 2003, une émission de télévision a été préparée avec la chaîne de télévision VTV2. Une première partie était consacrée à la demande des consommateurs pour la qualité des légumes et l'organisation des filières existantes pour les légumes « propres » et biologiques. Cette émission était à destination des consommateurs, des producteurs et responsables publics. Une deuxième partie, à l'attention des producteurs, portait sur les techniques de culture des légumes-feuilles sous filet.

Toujours en 2003, un article a été rédigé et publié dans la revue des consommateurs sur les points de vente de légume propres à Hanoi[74]. Enfin, beaucoup d'actions ont été menées avec la coopérative de Dong Du afin d'améliorer les informations données aux consommateurs par cette coopérative sur les efforts de qualité :

- un bulletin présentant les engagements de la coopérative en matière de production de légumes propres, ainsi que les différents types de légumes disponibles à la coopérative au cours des différentes saisons. Ce bulletin a été distribué en plus de 1500 exemplaires, notamment pendant les trois foires « légumes propres » de 2003 organisées par le comité populaire de Hanoi, qui regroupent une cinquantaine d'exposants sur le thème des « légumes propres » (principalement des entreprises de production) ;

- un panneau d'information dans le magasin du marché de Gia Lam, reprenant les informations du bulletin ;

- l'emballage sous plastique et l'étiquetage des légumes vendus au détail, avec indication de l'adresse de la coopérative, du contact téléphonique et du mode de production « propre » (voir étiquette en annexe). L'emballage et l'étiquetage n'est cependant pas systématique, certains consommateurs préférant l'achat des légumes en vrac.

Ces actions menées en 2003 et 2004 ont permis à la coopérative d'obtenir en 2003 un contrat avec un exportateur d'herbes aromatiques, à raison de trois livraisons par semaine, et 300 kg par livraison, et un chiffre d'affaires de 300,000 à 400,000 VND par livraison. Par ailleurs, les ventes du magasin sont passées de 70 kg à 100 kg par jour (progression de 30%), et le chiffres d'affaires de 150,000 à 200,000 VND/jour.

Appui au contrôle de qualité

Cette activité a eu lieu dans les coopératives des communes de Dong Du et Van Noi. Les collectes inopinées d'échantillons de légumes ont donné les résultats suivants :

A Dong Du :

- En août et novembre 2004, 8% des échantillons (sur 61) ont été trouvés avec des résidus de pesticides (correspondant à trois herbes aromatiques); suite à ces analyses, des discussions ont eu

[74] Nguyen Thi Tan Loc et Paule Moustier, 2003. Nguoi Hanoi mua rau an toan o dau ? (Where do Hanoi people buy safe vegetables?) Nguoi tieu dung, Avril 2003, p.4.

lieu avec les responsables des coopératives, qui ont révélé des délais trop courts entre pulvérisation et récolte, ce qui a permis de corriger les pratiques.

- En juin 2005, des excès ont été trouvés pour trois types de légumes aromatiques (33% des échantillons, sur un total de 33) ; suite à ces analyses, des discussions ont eu lieu avec les responsables des coopératives, qui ont montré des délais trop courts entre pulvérisation et récolte, ce qui a permis de corriger les pratiques. Aucun résidu n'a été trouvé en août 2005.

A Van Noi:

A Van Noi (village de Thon Dam, coopérative de Van Noi), les analyses de juin 2005 sur 15 échantillons ont indiqué 80% d'échantillons avec des résidus excessifs. Les résultats ont été transmis aux responsables des coopératives, de nouvelles analyses ont eu lieu avec le département de la protection des plantes mais les résultats ne sont pas encore disponibles.

Certification à Dong Du

Le projet a aidé la coopérative de Dong Du à remplir les différentes formalités nécessaires pour l'obtention du certificat du département de la protection des plantes :

- compilation de documents sur les formations IPM reçues, une lettre d'engagement à respecter les normes « légumes propres », les magasins vendant les intrants avec la liste des produits vendus, le type de mise en marché, la carte de la zone de production, indiquant notamment la localisation par rapport aux points d'eau.

- Contrôles inopinés avec collecte de trois échantillons de légumes, de sol et eau et analyses. Pour les légumes : nitrates, 7 types de pesticides, 6 types de métaux lourds, 3 types de pathogènes) ; pour le sol, nitrates, 4 types de pesticides, 6 types de métaux lourds ; pour l'eau, 6 types de métaux lourds, 3 types de pathogènes.

Sur un coût total de 400 dollars (6.6 M de VND) (pour une surface de 12.8 hectares), la municipalité de Hanoi a financé 240 dollars (3.8 M), la coopérative 80 dollars (1.2 M), et le projet Susper 100 dollars (1.6 M). La coopérative a reçu un certificat le 20 décembre 2005 pour une surface de 1.28 ha, correspondant à un village de 24 producteurs. Dans les autres villages, les chefs de groupe ne veulent pas passer du temps en formalités administratives, alors que la pression du département de la protection des végétaux comme des acheteurs est limitée (les acheteurs ne vérifient pas la surface indiquée sur le certificat, qui tient pour eux de gage de qualité sanitaire).

Le certificat doit être renouvelé tous les ans. En cours d'année, en juin 2006, un agent du département de la protection des plantes a visité les champs pour vérifier les pratiques d'utilisation des produits chimiques, ainsi que les produits vendus dans les magasins d'intrants. La coopérative a été informée à l'avance de ce passage mais pas les producteurs. La coopérative a souhaité renouveler le certificat en fin 2006, pour un coût de 62 dollars (1 M de VND). Le renouvellement du certificat passe par les mêmes analyses de plante, sol et eau qu'au cours du premier passage, et par une visite des champs et magasins.

Conclusions

Le projet Susper a augmenté les capacités des cadres des instituts de recherche et administrations vietnamiennes sur l'analyse des marchés. Il a également accru la coopération régionale sur ce sujet et mis en lumière la dynamique des échanges régionaux de légumes entre le Vietnam, le Laos et le Cambodge. La forte demande des consommateurs pour des légumes garantis comme sains a été révélée et communiquée à des groupements de producteurs. Les périodes et produits pour lesquels les prix sont les plus élevés ont été également transmis à ces groupements. Un système peu coûteux de collecte et de diffusion d'informations journalières sur les prix a été mis au point pour faciliter la négociation des producteurs avec les commerçants. De nouveaux modes de labellisation et de certification de la qualité sanitaire des légumes ont aussi été testés.

Les résultats sur les flux marchands de produits ont permis de guider le choix des zones de production pour les autres composantes du projet, en tenant compte de leur importance et de leur continuité dans l'approvisionnement de la ville. Ces résultats permettent aussi de disposer de données quantifiées sur le rôle des zones périurbaines en termes d'approvisionnement en produits frais des urbains, surtout pour les légumes-feuilles. Ces résultats ont intéressé tout particulièrement des personnes en charge de la planification urbaine à Hanoi comme à Phnom Penh (bureau des affaires urbaines de la municipalité).

Les suites des actions menées dans le projet Susper au Vietnam sont indiquées ci-dessous:

- il est prévu que l'ICARD continue le système d'information journalier sur les prix (avec un appui possible de l'ADB);

- les actions sur la labellisation et la certification des produits se poursuivent en 2006 dans le cadre du consortium Malica (Markets and Agriculture Linkages for Cities in Asia), un consortium réunissant le CIRAD, le VAAS (Vietnam Academy of Agriculture Science) et l'IPSARD (Institute on Policy and Strategies on Agriculture and Rural Development), en collaboration avec le projet ADB/DFID « Making Markets Work Better for the Poor ».

Dans les trois pays, l'accent mis par le projet sur le transfert de méthodes de recherche et d'intervention par des ateliers et publications est un gage de pérennité pour la plupart des actions réalisées, même si des financements devront être trouvés pour en augmenter l'échelle.

2.1 Vegetable Consumption Behaviour in Vietnam

Author(s): Muriel Figuié
Date: April 2003
Pages: 23
Published on website: Y
Published on hard copy: Y

Within the scope of the SUSPER project, an analysis of vegetable consumption was carried out in 2002. This dealt with both the quantitative (evolution of consumed quantities) and qualitative aspects (health risks associated with vegetable consumption) of vegetable consumption.

With nearly 6 million tons consumed per year, vegetables represent in volume the second main foodstuff in Vietnam after rice. The total increase in consumption results both from population growth (2% per year) and individual consumption increase (from 45.5 kg per person per year in 1987 to 54 kg per person per year in 2000). However, the value of consumed vegetables represents less than 5% of the total food consumption value.

The consumption of vegetables is higher for urban consumers than for rural consumers (+17%), and increases in proportion to household income. Vegetables constitute a major component of Vietnamese cooking. Cooking techniques seem to be changing, however, especially in urban areas. This is because vegetables are increasingly served with meat (the consumption of which is also increasing) or in meals prepared by street restaurants.

Another important point is that 88.5% of all Hanoi residents interviewed considered vegetables to be a health hazard due to the increasing use of agrochemical inputs. However, this concern does not seem to affect vegetable consumption because vegetables are thought of as having high nutritional qualities. Consumers also have faith in their own sanitation practices when it comes to choosing and preparing vegetables in order to avoid health risks.

2.2 An analysis of Food Demand Patterns in Hanoi: Predicting the Structural and Qualitative Changes

Author(s): Mubarik Ali, Nguyen The Quan, Ngo Van Nam
Date: 2006
Pages: 61
Published on website: Y
Published on hard copy: Y (AVRDC Technical Bulletin No. 35)

A comprehensive collection of household data using the 24-hour recall method in a repeated survey over three seasons enabled quantitative comparisons of food and nutrient consumption patterns in urban, peri-urban, and rural areas of Hanoi across various socio-economic groups and seasons. The relative contributions of different food sources were quantified highlighting the importance of farm and home garden production as well as various other food market types. This research also quantified the variation in prices across region, season and income groups to understand the dynamics of food scarcity and quality. Finally, estimates for price and income elasticity of various food and vegetable groups as well as for major nutrients important for human health were made. It is expected that this quantitative analysis of food and nutrient consumption pattern, price variation and demand elasticity will help policy makers predict demand changes in Hanoi and formulate efficient food policies.

The analysis suggests that consumption in Hanoi is still dominated by cereals, at least in quantitative terms. However, with urbanisation and increasing incomes, this is changing fast. The role of livestock products, fruit and aquatic food is expected to increase dramatically, as these food components have much higher shares in the dietary pattern of urban Hanoi and of upper income groups, both in terms of quantity as well as expenditure. Moreover, diversity of food in terms of demand for small food items (grouped as “others” in this study) will also be enhanced. Vegetables, currently occupying second place in the dietary patterns of Hanoi, are an important source of micronutrients especially for low-income groups, and these will also increase with higher incomes and urbanisation. However, the rate of increase in vegetable demand will be far less than the increase in livestock products. The high increase in livestock products should be a cause of concern, as it may lead to obesity. Policy makers should control this trend using appropriate price and tax policies, as livestock products respond strongly to these fiscal tools, and by enhancing vegetable supply through technological innovation in their production and marketing systems.

Farms are the major source of food in peri-urban and rural areas of Hanoi, and the low-income groups of the city, which rely more on this source. Therefore, strengthening the production of urban and peri-urban Hanoi farms through technological innovation can contribute greatly to enhancing food security especially for low-income groups in Hanoi and farmers themselves. In supplying vegetables, fruit, meats, eggs and milk, the contributions of home gardens for farm families are even higher than those of farm production.

In urban areas temporary unrecognized or informal markets turned out to be the major source of food supply. Policy makers normally consider these markets as a problem for the city and a source of contaminated food. Usually, unnecessary restrictions are imposed on the sector. This simply increases the cost of food supply to the poor. Recognizing this as an important source of not only food but also employment, the government should integrate the sector into formal markets by providing appropriate space and licensing and equipping them with appropriate tools and skills to keep food hygienic. Enhancing the food processing skill of the sector can also help them integrate with the formal food market.

Contrary to normal perception, overall food consumption was highest during the hot wet season and lowest during the cold wet season both in terms of quantity and in terms of expenditure. Greater consumption during the hot wet season may be due to the increased requirement of the human body in this season, rather than due to the food supply situation. The consumption of vegetables was lowest and their price highest during the hot wet season, but the low consumption of vegetables was compensated by high consumption of tropical fruits. Moreover, the consumption of leafy vegetables,

which can be favourably grown during the hot wet season, was also enhanced during this season. Therefore, seasonality in food supply did not have significant impact in terms of nutrient availability. The implication is that policy makers should not worry about reducing seasonality in food supply, but rather should focus on improving the overall food supply to the city wherever and whenever possible. Trade and natural adjustment in the production system based on comparative advantage of different crops are efficient tools to tackle seasonality in food supply. Agriculturalists should aim to resolve the production problems of hot wet season crops, such as leafy vegetables and tropical fruits, rather than introducing new crops in this season and overcoming seasonality in a particular food item.

On average, there seems to be no serious nutrient deficiency in Hanoi and its surrounding population. Nevertheless, looking at individual families on a daily basis, a large number of families fall below the daily recommended intake levels of calcium, vitamin B1, vitamin B2, and niacin. A small proportion of the population are also deficient in calories, vitamin A and vitamin C. All regions and income levels have these deficiencies (although to small extent it varies across income groups and regions). This suggests that low incomes are not the only cause of nutrient deficiency. Lack of nutrient knowledge is also part of the problem. Therefore, to diversify food, efforts are required to improve the nutrient knowledge of the population. Policies can also play an important role in alleviating micronutrient deficiencies. For example, reducing the prices of seafood and vegetables, especially of water convolvulus, can reduce calcium deficiencies significantly.

2.3 Consumer Perception of Vegetable (Tomatoes and Water convolvulus) Quality in Hanoi

Author(s): Muriel Figuié
Date: Jun 2004
Pages: 24
Published on website: Y
Published on hard copy: Y

A quantitative survey conducted in 2003 using 500 Hanoi consumers has allowed us to identify their perception of peri-urban vegetables. Following this, a qualitative survey, based on word association, has allowed us to identify with more detail the perception of those consumers in regards to the two most widely consumed vegetables: tomatoes and water convolvulus. Consumer perception is that a good tomato is one which is floury (a descriptive term meaning fleshy and dry rather than pulpy and moist), firm and fresh. Likewise, good water convolvulus comes from a pond and has slender stems and green leaves.

The study focused on quality perceptions of products from China, products from Dalat, peri-urban products, organic products, “safe” products, and products sold in supermarkets. The results of this study demonstrate that consumers appreciate these products their ‘healthy’ qualities on the one hand and their visual and organoleptic qualities on the other. Chinese products fall short on all counts. Supermarket products are highly desirable but are considered expensive. Organic and “safe” vegetables have bad visual and organoleptic qualities and “safe” vegetables do not inspire confidence. On the contrary, peri-urban produce has high visual and organoleptic qualities but are not considered healthy. Confidence in product quality is largely a function of the seller’s image and the place of sale.

Among other conclusions, this report recommends that suppliers be extremely aware of the strong sense of value that consumers have for ‘freshness’. Another recommendation is that the marketing chain of safe vegetables should work within its sphere of influence to improve visual quality.

2.4 Consumer Behaviour Regarding Fish in Ho Chi Minh City

Author(s): Le Thanh Hung, Nguyen Thi Thanh Truc, Nguyen Phu Hoa, Huynh Pham Viet Huy, Bui Thi Phuong Thao, Boun-Tieng Ly
Date: January 2004
Pages: 21
Published on website: N
Published on hard copy: N

This study surveyed the socio-economic conditions of households and their perception of freshwater fish consumption. It also tried to measure the impact of socio-economic factors with the health concerns that affect the quantity of fish consumed by all households. To measure the impact of these factors, an econometric model for snakehead fish was developed to measure the impact of income, price, substitutes, taste and food safety concerns on demand.

Demand for snakehead fish, which is the most popular fish on the market, is quite elastic due to the price of the product and the income of the households. Fully 35% of the households interviewed rank fish (especially snakehead) first in terms of nutritional value, just below beef, which 43% of the households rank first. When comparing the quality of farm fish to caught fish, more than three quarters of consumers said that farm fish is of lower quality than caught fish, especially in terms of firmness and smell. Study results also show that consumers do not have enough information on the safety of fish. However, most of them do have concerns about; water quality, origin of fish feed, heavy metal content and toxic substances in the product and the colour of the fish.

2.5 Spatial and Institutional Organization of Vegetable Markets in Hanoi

Author(s): Hoang Bang An, Isabelle Vagneron, Le Nhu Thinh, Dang Dinh Dam, Ngo Van Nam, Le Thuy Hang, Trinh Quang Thoai, Paule Moustier
Date: April 2003
Pages: 57
Published on website: Y
Published on hard copy: Y

Thanks to improving living standards, Vietnamese have been consuming increasing amounts of fresh vegetables over the past ten years. Yet, the market for fresh vegetables seems quite chaotic and disorganized. This research links together seasonality, the organization of supply/transportation, the origin of the vegetables sold, the identity of the vegetable sellers, the marketing chain and the overall level of activity in the markets. Moreover, it highlights the major role played by peri-urban farmers in the supply of food to the city. Also covered is the importance of off-season production, through the extension of hot season cultivation of temperate vegetables (tomatoes, cabbages) near Hanoi and through the diversification of production away from some of these crops (cabbages) during the cold season. Lastly, the data gathered by the study shows the number of farmers present at the markets and the atomized nature of the vegetable trade.

The main results of the survey indicate that almost all leafy vegetables sold in Hanoi are grown close to the city. Although leafy vegetables can be grown throughout the year, their yield may decrease during the cold season. Yet, these vegetables never come from outside the Red River Delta. Leafy vegetables are mainly sold by the producers themselves, yet traders are present in higher numbers at some times of the year. This is due to the economics and labour demands producers experience.

Most temperate vegetables come from the Red River Delta during the cold season. Eighty-one percent are sold by producers who quit selling in the hot wet season because they do not have enough products to sell (84%) or because they are busy on their farms (40%). A change in the origin of the temperate vegetables occurs at this time, with vegetables coming from as far as China. Most vegetables are transported to the market with two-wheeled vehicles (bicycles and motorcycles). Trucks transport a very small share.

Seasonality was also studied through the analysis of vegetables retail prices gathered at two urban and two peri-urban markets of Hanoi over a five-year period (1996-2001). The data shows firstly that vegetable prices grew faster than that of the overall price index. This may be explained by the increasing demand for vegetables. Secondly, that vegetable prices experience very strong seasonal variations, especially temperate vegetables that must be brought from distant provinces (or China) during the summer. Seasonal price variations match the results of the origin of fruity vegetables and changes in the activity of the markets over the year.

By linking together the origin, distribution, marketing, seasonality and identities of participants, the report helps accentuate the need for improved information flows about prices, volumes and areas of production throughout the year.

2.6 Development of Shops and Supermarkets in the Fresh Vegetable Commodity Chain in Hanoi and Ho Chi Minh City

Author(s): Nguyen Thi Tan Loc
Date: April 2003 (extended summary) – December 2002 (full report)
Pages: 35 (extended summary) – 105 (full report)
Published on website: Y in Vietnamese and French (extended summary of report)
Published on hard copy: Y (report and extended summary)

During recent years, there has been considerable urban growth in Hanoi and HCMC. The increase in population will inevitably cause an increase in the need for food products. It is therefore necessary to plan market development in advance in order to balance supply and demand.

Besides the traditional market, a new market has been developing over the last five years involving self-service stores and supermarkets. In 2000, a study funded by CIRAD was conducted in cooperation with RIFAV on the development of supermarkets and the impact this is having on the vegetable supply chains. The study was based on a census of supermarkets and interviews with a sampling of managers involved in supermarket supply

Results from this study show that, at the time of study:

- There are 35 stores (S) and supermarkets (SM) distributing fresh vegetables in Hanoi, 21 in HCMC. They are concentrated in city centre areas. This represents an obstacle for buyers living in remote areas.
- The sale strategies of the shops and supermarkets are characterized by their broad choice of vegetable types and their concern for vegetable safety. The quantities sold are low compared with the consumption of fresh vegetables of the two cities.
- All Ss and SMs are aware of the situation and have plans to increase sales with improved services and larger choices, especially for off-season vegetables; they are constantly searching for new suppliers and deepening relationships with their usual suppliers.
- The other stakeholders need much support from public bodies to solve some of their problems: The safe vegetables produced are not certified by any authority; collectors and farmers have inadequate transportation capacities; consumers are concerned because they do not really know where to purchase safe vegetables nor how to recognize them.

This general study shows that despite non-stop development, fresh vegetable distribution in stores and supermarkets still is encountering many difficulties. One of the solutions for a good match between supply and demand would be to improve information, with effective coverage in the media about safe vegetables and locations where they are sold. Currently, the city authorities along with the People's Committee, the Department of Agriculture and the Department of Trade have taken a number of measures regarding the production, transportation and distribution aspects in order to satisfy the demand for fresh vegetables of these cities.

[Note: a more detailed report on supermarket development and strategies in Vietnam was written by the MALICA consortium for ADB/DFID Markets for the Poor project and is available at http://www.malica-asia.org: Moustier, P., Dao The Anh, Hoang Bang An, Vu Trong Binh, Muriel Figuié, Nguyen Thi Tan Loc, Phan Thi Giac Tam (eds.). The participation of the poor in supermarkets and other food distribution value chains in Vietnam. Hanoi, CIRAD/ADB, 324 p].

2.7 Strategies of Stakeholders in the Vegetable Commodity Chain Supplying Hanoi Markets

Author(s): Ho Thanh Son, Bui Thi Thai, Paule Moustier
Date: 2003
Pages: 50
Published on website: Y
Published on hard copy: Y

The study focuses on four product flows from four different supply districts. Firstly, the safe vegetable flow from Dong Anh, the main safe vegetable supplier of supermarkets, stores of state-owned and private companies, canteens of schools and kindergartens. Secondly, the normal vegetable flow from Me Linh, an important vegetable supplier of the Dich Vong wholesale market. Thirdly, the vegetable flow from Gia Lam, the main vegetable supplier of the Bac Qua-Long Bien wholesale market. Finally covered is the vegetable flow from Thanh Tri, the main vegetable supplier of the Mo and Nga Tu So markets. It is based on in-depth interviews of a panel of farmers and traders belonging to each selected vegetable chain.

The relationship between the producing areas and markets is dependant on the distance from producing region to markets and the strategies of quality management. The safe vegetable channel is characterised by a close relationship between stakeholders. The retailers are the stakeholders regulating the chain. They inform the stakeholders upstream about the demands of the market and induce them to be more efficient. The biggest constraint to this flow chain is that consumers have little confidence in product quality. The demand for safe vegetables is increasing but producers often cannot find regular outlets for their safe vegetables.

In the normal vegetable chain (supplier-wholesale market), the assignment of the different actors is relatively clear. However, in almost all three flows, the relationships among them are very loose. The irregular involvement of many farmers in the market (although some peri-urban farmers participate more frequently) makes the flows less centralized. This is a reason why information transmission from the market to producing regions is very scattered, and this affects the income of the stakeholders.

Product quality is one of the key factors. This is a common link to connect the actors participating in the commodity chain and is clearly expressed in the safe vegetable flow. Presently, in peri-urban districts, the pressure of urbanisation and the reduction in cultivated area have led farmers to change their strategy. They choose vegetables that are more profitable and strive to improve quality to raise the income generated per area unit. Nevertheless, to entice customers to buy at higher prices, it is important to build consumer trust that the produce meets the quality mentioned on the labels. A good first step is to help actors themselves raise the standard of product quality. In addition, it is necessary to enable consumers to have the means to check produce quality. In any case, the State should act as a referee to make sure that actors comply with the regulations.

2.8 Costs and economic results of some vegetable production processes

Author(s): Ho Thanh Son, Nguyen Hung Anh and Paule Moustier
Date: 2003
Pages: 8
Published on website: N
Published on hard copy: N

The report aims to compare the costs incurred by and returns from ordinary vegetables, safe vegetables and organic vegetables from production to the retail stage. It is based on surveys of 30 growers (Van Duc, Gia Lam), 4 collectors and 5 retailers for ordinary vegetables; 32 farmers (Van Noi), 4 collectors and 5 retailers for safe vegetables; 3 organic farmers (Lien Mac, Tu Liem) and a company that distributes organic vegetables. Financial costs and benefits have been assessed for two vegetables, cabbage and pakchoy.

Production costs increase when moving from regular vegetables to safe vegetables and then on to organic vegetables, despite lower pesticide costs. Of these costs, labour costs are the highest; seeds and manure costs are also higher. Vegetable productivity tends to decrease when the farmer moves from regular vegetables to safe vegetables and finally to organic. However vegetable prices are higher for safe and organic vegetables. Thus for the same growing area, organic vegetable growers gain the highest return, followed by safe vegetables then regular vegetables.

Collectors of safe vegetables have to pay higher taxes, telephone charges and transportation costs. Another difficulty faced by individual safe vegetable collectors is that their total income from collecting safe vegetables is lower than for regular vegetables. The reason is that the volume of safe vegetables collected is often smaller than that of regular ones. This is one factor that deters safe vegetable collectors from entering the market.

Retailers of safe vegetables pay higher costs than regular vegetable sellers due to higher monthly stall costs and taxes. But the profit the retailer makes from one unit of safe vegetables is higher due to its higher price. This is one factor that encourages different economic sectors to get involved in the safe vegetable marketing process.

2.9 Safe Vegetable Production Process of Some Co-operatives in Van Tri Village – Van Noi – Dong Anh

Author's name: Ho Thanh Son
Date: 2005
Pages: 23
Published on website: N
Published on hard copy: N

The objective of the report is to assess whether the farmers of Van Tri village actually comply with the regulations applying to safe vegetable production. Farmers of Van Tri village are major suppliers of safe vegetables to schools, shops and supermarkets. The report is based on in-depth interviews with 30 households in 3 cooperatives in Van Tri village, on their actual practices in terms of fertiliser and manure use, as well as pesticide and water use compared with the "safe vegetable regulations" issued by the Ministry of Agriculture in terms of products allowed, time frames between application and harvest and source of water. Three vegetables were investigated: cabbage, tomatoes and Chinese peas. The results show that farmers generally adhere closely to the regulations, although in some cases some (harmless) pesticides that are not allowed were used, the period between spraying and harvesting was exceeded by a few days and some excess use of phosphate was observed.

2.10 Vegetable Pesticide Residues in Selected Fields and Points of Sale in Hanoi

Author(s): Nguyen Kim Chien and Paule Moustier
Date: 2006
Pages: 18
Published on website: N
Published on hard copy: N (internal document)

This study assesses vegetable safety as regards pesticide residues for selected farms and points of sale. The research is aimed at making farmers and traders more aware of potential excess pesticide residues and allowing them to take the appropriate corrective measures. It also aims at confronting the reputation of supermarkets and vegetable safety by using actual measures of chemical residues in different points of sale. The research combined quick test analysis developed by the Taiwan Agricultural Research Institute and gas chromatography (used when excess pesticide residues were found by the quick test).

The research suggests that the safest point of sale is the organic vegetable shop, followed by supermarkets and safe vegetable shops, while wholesale and retail markets, both formal and informal are the ones with the highest prevalence of pesticide residues. At the farm level, pesticide residue analysis was used as a tool for farmers of one cooperative to improve the time between spraying and harvest with some efficient results. Finally, the report details the limits of the study and the need for additional research.

2.11 Vegetable Market Information and Consultation Systems in the Mekong Region

Workshop proceedings, RIFAV, May 9-13, 2005
Author(s)/Editor(s): Hoang Bang An, Paule Moustier
Date: 2006
Pages: 191
Published on website: Y
Published on hard copy: Y

From May 9-13, 2005, a regional workshop on Market Information and Consultation Systems (MICS) was held at RIFAV (Hanoi). The workshop used the SUSPER experience in presenting methods for collecting, processing and disseminating market information suitable for use by private and public stakeholders involved in vegetable marketing to make decisions.

Dr Paule Moustier gave a presentation on objectives, method and problems of MICS at the international level. Various authors in the economics and marketing field have highlighted the importance of market information for adjusting supply and demand and enhancing farmers' bargaining power in dealing with traders. Yet an overview by the FAO showed that most market information systems around the world are little used, especially by farmers. The reasons include the low reliability and lack of timeliness of collected price data, especially for perishable products and the poor dissemination of information. Certain conditions explain the success of some market information systems, e.g. MIS in Indonesian or MANOBI in Senegal. These include speedy dissemination, keeping the system simple and inexpensive and combining market information with technical information. Equally important are consultations with stakeholders about strategies to take advantage of market opportunities, conducting a preliminary assessment and an impact assessment, along with combining public and private funding.

Vegetable MICS from three participating countries (Vietnam, Cambodia and Laos) were presented. The SUSPER Market Information System in Hanoi was presented by the three institutes involved. They are the RIFAV for data collection and system management, ICARD for data storage and dissemination on TV and websites and finally, DA for data dissemination to farmers in four Hanoi project sites, as well as an impact assessment. (A summary of the system is available in the annotations of the individual presentations.) Fruit and vegetable market information systems in southern Vietnam were also presented by ICARD and results on fish marketing, which can serve as a base for establishing a fish market information system in Ho Chi Minh City, were presented by the HCMC University of Agriculture and Forestry. Vegetable price market information from the Agriculture Marketing Office (MAFF) of Cambodia was presented, as well as a stakeholder workshop organised by SUSPER to disseminate and discuss vegetable marketing opportunities in Cambodia and Laos.

The presentations for the three countries showed a combination of market information collection for mid-term planning objectives (a supply calendar for crop planning) and information for short-term decision-making (daily price data for price bargaining). In the first two years of the SUSPER project, the focus was on mid-term planning objectives by gathering information on market seasonality, in Vietnam, Laos and Cambodia; then consulting with farmers and traders through stakeholder workshops. This enabled us to identify the demand for short-term decision-making information, which led to the establishment of the daily price information system in Hanoi. Parallel to this ICARD/MISPA was setting up fruit and vegetable market systems in southern and later in northern Vietnam with CIRAD methodological support. In Cambodia and Laos, weekly price information was gathered by the Planning Division of the Ministry of Agriculture with the support of the FAO (and the ADB in Cambodia), so SUSPER focused on trying to improve methods for the collection, analysis and dissemination of price data.

The tools of price statistical analysis presented by Dr Ludovic Temple from CIRAD enable us to go further in terms of the analysis of trends and seasonality and instability of prices. This price information can help influence public and private decision-making relating to production and

marketing. The AgriMarket software from the FAO introduced by Ms Chan Sipana (MAFF) is another tool that makes the presentation of price data more user-friendly.

Participants also had a night market visit in Hanoi to discuss with contact traders involved in SUSPER MICS and practised the control of price information in working groups and compared data with that collected by RIFAV via telephone on the same day.

The workshop enabled us to establish some clues to avoid the various pitfalls involved in the setting up and running of market information and consultation systems. These pitfalls explain the present limited use by farmers of these systems. The positive feedback from farmers using the Hanoi vegetable MICS set up by SUSPER shows the efficiency of having an adequate protocol for data collection, particularly in terms of frequency of collection (daily prices) and a grading system that takes account of quality variations. Also highlighted was the preferential method for data dissemination adapted to the capacities of stakeholders (television for Vietnam, radio in Cambodia and Laos).

2.12 Basic Information on Project Sites in Hanoi Peri-urban areas

Author(s): Mai Thi Phuong Anh, Nguyen Thi Tan Loc, Le Nhu Thinh, Ho Thanh Son, Paule Moustier
Date: Jul 2004
Pages: 24
Published on website: Y
Published on hard copy: Y

In order for the SUSPER studies to be more efficient and effective, the evaluation sites have been concentrated. Four communes have been chosen according to different criteria: (1) importance and regularity in vegetable production and Hanoi market supply; (2) willingness of authorities to develop vegetable production; (3) location in the peri-urban area, less than 30 km from city centre; and (4) possible off-season production owing to a location in non-flooded areas.

According to these criteria, four communes were selected in four districts, two in Hanoi province and two in surrounding provinces : Dong Du (Gia Lam district, Hanoi Province), Dong Anh (Tien Duong district, Hanoi Province), Tien Phong (Me Linh district, Vinh Phuc Province), Vo Cuong (Bac Ninh Province).

This report generated detailed data that will be useful for researchers in the immediate environment. The criteria for the project sites are explained with particular reference to the supply chain in Hanoi. The data is statistical in nature and provides a useful toolset for further study.

2.13 Market Analysis for Freshwater and Marine Fish in Ho Chi Minh City

Author(s): Le Thanh Hung, Nguyen Thi Thanh Truc, Boun-Tieng LY
Date: Aug 2004
Pages: 33
Published on website: N
Published on hard copy: N

A survey was conducted to gather information on the origins, quantities, prices and organisation of marketing chains of fish marketed in Ho Chi Minh City. It covered 38 collectors, 57 wholesalers and 330 retailers.

About 83% of fish production for HCMC markets comes from the Mekong Delta while 12% originate from southeastern provinces and 5% is from peri-urban areas of the city. Out of many species from the delta, snakehead (25%) and Pangasius (Hu) (19%) are most numerous. Giant gourami, red tilapia and tilapia mainly originate from the peri-urban areas of HCMC. 83% of fish available from the delta are cultured fish and available year round, whilst only 6% are from the wild. Conversely, fish from peri-urban areas are mainly cultured fish but seasonally dependent. The most common marine fish sold are anchovy and hemibagus.

Fish products are sorted into classes based on: quality, size and freshness. Higher classes command correspondingly higher prices. 54% of fish products are first class, 43% second class and 3% are third class. First class fish are currently sold in urban markets (high-income customers) while third class fish are sold to peri-urban areas (low-income customers). Fish price and volume vary according to many factors including availability of marine fish or vegetables that act as alternatives.

San Ca 50, Xom Cui, Cau Ong Lanh markets are three main sources of fish products for retailers. Transportation is mainly motorbike, sometimes bicycle. Price fluctuations throughout the year result in difficulties for retailers. Cash sales (no credit) in San Ca 50 are another constraint for retailers.

Products from fish-growing operations are important food/income sources for many people. Although transportation and storage facilities are monitored by the Municipal Veterinary Department, inappropriate facilities and methods of storage are not controlled. Clean water is seriously scarce in many markets. Furthermore, sellers often use chemicals in transportation and preservatives for the storage of fish. There is a need to create awareness of food safety and hygiene at all levels of the chain.

Related organizations or market administrative committees should be more concerned with the transparency of prices in order to have more uniform prices for a given class of product. The current market prices should be displayed prominently so that customers can see them easily.

2.14 Vegetable Market Flows and Chains in Phnom Penh

Author(s): Chhean Sokhen, Diep Kanika, Paule Moustier
Date: Nov 2004
Pages: 50
Published on website: Y
Published on hard copy: Y

The main objectives of the research are: (1) to understand the organisation of the market in terms of the geography of produce flows and stakeholders' functions, (2) appraise market performance in terms of import competition/supply variations and (3) to set the basis of an information system on origins and quantities.

To reach these objectives, a review of the available data was conducted. Then rapid market surveys were implemented to investigate market flows and chains. The surveys were conducted on one fifth of traders in the three largest markets selling vegetables: Oressey (retail market), Dumkor and Chaba Ampou (wholesale and retail markets). Questions mostly related to the origin of supply, function of middlemen, calendar of supply and quantities sold. Eight commodities were selected according to their importance in consumption and in peri-urban agriculture: tomatoes, cabbage, Choy sum, Chinese cabbage, lettuce, cucumber, yard-long green beans, water convolvulus (kangkong). The surveys were conducted three times in 2002 (April, July and October) and four times in 2003 (January, April, July and October).

Comparisons were made with previous surveys carried out in the market (including those carried out by FAO and AGRISUD). This survey aimed at quantifying origins and flows of vegetables available in the market, although difficulties in getting data on quantities are manifold (especially the fact that many of the wholesale transactions take place at night and traders are reluctant to answer).

From the survey results, vegetables can be categorised as follows according to their origin (the distance between production and markets is related to product characteristics, with most perishable vegetables originating from areas closest by; the origin is also related to climatic constraints and land availability):

Imported vegetables

- These vegetables mostly come from Vietnam. This is the case of tomatoes which come from Vietnam for 91% or more of transactions in 2002 (100% in April, 94% in July and 80% in October) and 60% or more transactions in 2003, except in January (25% in January,73% in April, 94% in July and 93% in October); the remainder originated from Kandal, Phnom Penh (Chamcarmon) and Kampong Speu province in October 2002; cabbage originated from Vietnam for 86% or more transactions in 2002 (100% from Vietnam in April and October, 95% from Vietnam in July and 5% from Kandal), in 2003 (77% from Vietnam in January,97% in April, 99% in July and 99% in October), the rest came from Kandal and Kampong Cham; Chinese cabbage: 100% from Vietnam at the three periods in 2002, while in 2003 it comes from Vietnam 99% and from Kandal 1% in January and April, and 100% as well as from Vietnam in July and October.

Local vegetables

- Vegetables that only come from Phnom Penh municipality (maximum of 20 kilometres from centre): this is the case of water convolvulus: 53% from Dangkor district, 43% from Meanchey district, 3% from Chamkamon and 1% from Russei Keo in 2002. And 46% from Dangkor, 52% from Meanchey, 1% from Chamkarmon and 1% from Russei Keo in 2003.
- Vegetables that mostly come from Kandal province (20-40 kilometres from centre) for more than 98% in 2002 and 99% in 2003 of transactions (the rest from Phnom Penh municipality): this is the case of choysum (Kandal province: Saang, Takhmao Mokampoul, Kandal Stung, Ponhealeu and Kien Svay districts, Phnom Penh: Russei Keo and

Chamkarmon districts), lettuce (Saang, Kien Svay Takhmao, Mokampoul, Lek Dek and Bakheng), yard-long beans (Saang, Kien Svay, Takhmao, Mokampoul, Kandal Stung, Pnhealeu, Banteidek and Lek Dek).

- Vegetables that come from Kandal, Kampong Speu, Kampong Chhnang, Takao and Phnom Penh (50 kilometres beyond Phnom Penh): this is the case of cucumber (99% from Kandal in April, 60% in July, 23% in October in 2002 and 2003: 77% in January,100% in April,73% in July and 62% in October from Kandal), the rest is from Kampong Speu (27% in July and 34% in October) and Kampong Chhnang (1% in January).

The classical result is that the longer the distance between the production area and market, the more middlemen there are. This is shown by the survey results: more than half of the retailers get water convolvulus directly from producers, as this vegetable is produced around Phnom Penh, while vegetables from Kandal and Vietnam usually go through collectors and wholesalers (and the wholesaler stage is more frequent in the case of vegetables from Vietnam than in the case of vegetables from Kandal, which may go directly from collectors or producers to retailers). Transport takes place by motorbike in half the cases, the other means of transport are by foot or by truck. 70% of traders sell all year round. The main reasons for stops in the activity are the floods during the rainy season, as well as ceremonies in January and April.

The surveys provide information for the selection of project sites relative to their importance in the vegetable supply: Phnom Penh municipality for work on water convolvulus; Saang district for work on the other vegetables. They stress the importance of increasing the scale of production and assembling in the present periods of shortage for the local supply to be competitive with respect to imports. Vegetable imports mostly correspond to the deficit in local production due to heavy rainfall and high temperatures in the rainy season (from May to October, with floods mostly from August to October) and also to water deficits in the dry season (especially from February to May). When available at the same time, the prices of local and imported products are similar or lower than local products. It is stands out that in January 2003, tomato imports dropped to 25% of the total supply owing to favourable climatic conditions. Hence there is some leeway for local production to substitute for imports if the water availability is improved during the dry season and if innovations are promoted to grow tomatoes, cabbage and Chinese cabbage in the rainy season.

2.15 Socio-economic Strategies and Results of Traders in Cambodia

Author(s): Chan Sipana, Paule Moustier
Date: Jul 2004
Pages: 45
Published on website: Y
Published on hard copy: Y

This study aims at a better correlation between the locally produced vegetable supply chain and market demand. The main objective of the survey is a better understanding of the strategies of the market agents in terms of sources of supply, relationship with suppliers and customers, nature of transport, access to information and an evaluation of their costs and returns.

Fifty-one traders were interviewed in three urban markets: Chbar Ampou and Dumkor (wholesale and retail markets) and Oressey (a retail market) in May-June and September 2002. The stakeholders are retailers (permanent and semi-permanent, the latter selling half the day or temporarily), permanent and temporary wholesalers, collectors and producers (some selling wholesale, some selling retail). The majority of traders (more than 80%) sell all year round. Around half the interviewed traders have developed regular relationships with their suppliers (this applies for imported as well as local products), which means that they are given priority in terms of supply and purchase throughout the year. This diminishes the risks of unsold products for suppliers and of a lack of supply for purchasers. Incomes and marketing margins are highly variable among traders. On the average, net profit does not exceed 25% (of purchase value) for all categories of traders. The analysis suggests a positive relation between the amount of income, the quantity traded and the access to regular suppliers.

The most popular means of transport are motorbikes (45%) and handcarts (14%) which are rented rather than owned.

Answers for the comparison between local and imported products suggest that imported products are larger and are available longer but that local products taste better and are safer. In the study period tomatoes, cabbage and Chinese cabbage originated from Vietnam.

Poor marketing conditions and limited product availability are difficulties stated by the traders. Although 70% listened to the radio to get price information, the majority said that it was not useful because the information was out-dated and/or inaccurate. Responses indicate that the conditions for more successful vegetable distribution could be improved by upgrading marketplaces and making the local supply more regular throughout the year.

2.16 Opportunities for Vegetable Marketing in Phnom Penh from Peri-urban areas

Author(s): Paule Moustier, Chhean Sokhen, Chan Sipana
Date: 2005
Pages: 9
Published on website: Y
Published on hard copy: Y

The paper is a synthesis of the two previous reports (2.9 and 2.10), plus additional market data collected in 2004.

The results of this paper show that local produce can gain market share on imported produce sold in the daily markets. For the eight surveyed vegetables, 90 tons are traded every day, of which 35 tons are imported and 45 tons are local. Imports from the mountainous area of Dalat, Vietnam, are most likely to involve tomatoes (90% imported in July and October), cabbage (95% imported in July and October) and Chinese cabbage (100% imported all year round). These three vegetables were the focus of the study. Onions, potatoes and carrots are also known to be imported. Obviously, when local production is more available (January) then imports from Vietnam decrease. Prices follow the local pattern of seasonality: prices are commonly 50-100% higher in the rainy season. Some technical solutions can be applied in terms of production. Adapted varieties and the use of non-flooded nurseries (as tested by AGRISUD) as well as grafted tomato/eggplant combinations were tested and proven in the rainy season at the Day Eth SUSPER research station.

The supply chains are organised similarly regardless of the origin of the produce. Whilst some wholesalers may specialise in imported vegetables they may vary their quota based on local availability. Collectors who go out to the peri-urban farms, the border or even across to Dalat supply wholesalers with whom they have an established relationship. Wholesalers supply 90% of the retailers.

The following characteristics are preferred in imported tomatoes, cabbage and Chinese cabbage: appearance (bigger size for imported products, more regular shape), as well as the longer availability. On the other hand, local products are preferred in terms of taste, reputation for safety, and longer shelf life. As regards the prices, they are similar when considering the same quality of product (Cambodian produce is commonly 10 to 50% cheaper than Vietnamese products although their appearance is not as good as the Vietnamese).

To ascertain if the reputation for safety is realistic, we conducted pesticide residue analysis on imported and local vegetables, collecting without prior notice five samples per local vegetable in Kien Svay district (tomato, Chinese cabbage, green mustard) and five samples of imported vegetables (cabbage, tomato, Chinese cabbage). These samples were tested in the Hanoi Research Institute on Fruits and Vegetables by quick tests developed in Taiwan. Excess pesticide residues were found in imported cabbage, local Chinese cabbage and local green mustard. This suggests that there are safety risks on imported as well as local vegetables. These analyses have to be replicated on a larger sample—involving samples from vegetables grown with IPM techniques with the support of FAO and Srer Khmer, using the equipment that has been supplied recently from SUSPER project to the Department of Agro-industry.

Traders take low margins on average: less than 25% of the purchase value. Income is narrowly connected to the quantities traded and the lowest incomes are obtained by retailers who sell on average 70 kilos of vegetables per day. Conversely, the highest incomes are earned by permanent wholesalers who sell on average 1.3 tons of vegetables per day, but they face the highest fluctuations. Motorbikes are used in half the transactions to transport products from collection point to resale point, the rest being trucks, mini-buses, carts. The constraints most commonly mentioned by traders are the lack of availability of vegetable supply and the limited space for marketing, especially for wholesale, which takes place in a muddy and dirty environment.

A stakeholders' workshop helped in changing the farmers' perception on the role of Vietnamese imports: while they commonly think that Vietnamese imports prevent them from growing vegetables

at a profit, the figures showing yearly variations in imports suggest that if farmers are successful in producing more regularly then Vietnamese imports will decrease. The farmers expressed their need for information on the supply calendars of the market, daily prices and use of pesticides, as most of the labels are in foreign languages. The preferred means of dissemination for market and technical information is the radio.

This report is a synthesis of the previous (summary 2.9) and the following (summary 2.11) reports.

2.17 Vegetable Marketing in Vientiane (Lao P.D.R.)

Author(s): Somsack Kethongsa, Paule Moustier and Khamtanh Thadavong
Date: Nov 2004
Pages: 55
Published on website: Y
Published on hard copy: Y

The main objective of research on vegetable marketing in Laos is to help harmonize vegetable production with the market demand in terms of quantity, quality and price.

A review of existing data was carried out, especially the JICA and FAO studies on food marketing in Laos. The studies point out the importance of the Vientiane plain for fruit and vegetables in addition to Boloven Plateau (Champassak province) which mostly provides cabbage and potatoes. The three major food markets are Tong Kan Kham, That Luang and Kua Dim; they operate both as wholesale and retail markets. Market traders usually combine a variety of functions and specialised wholesalers are few.

Two surveys were organised to gain additional information. The first one, investigation of market flows and chains (activity 1) aims at appraising how the market is organised spatially and in terms of functions and to quantify the supply from the different districts/villages and imports. The second one, appraisal of traders' strategies, aims at : (i) finding out the structure of the market (competition) and coordination relationships among the different actors ; (ii) comparing the different origins (peri-urban, rural, imports) in terms of price, quality and availability of commodities ; (iii) identifying advantages and constraints of actors including access to information. The surveys took place in Tong Kan Kham, That Luang and Kua Dim markets. For the investigation of market flows and chains (activity 1), around one-third of market agents were interviewed, accounting for 92 people. The survey took place only once, in June, but data was collected on the variations during the year. Activity 2 took place in August on a sample of 50 traders. In the two surveys, the sample includes the different stakeholders present in markets (retailers, wholesalers, assemblers, producers).

Among the selected vegetables, the following are subject to imports: Chinese kale; round tomatoes and olive tomatoes; big Chinese mustard; cucumbers, while the others (pakchoi, also called choysum), small Chinese mustard, lettuce, yard-long beans, cherry tomatoes) only originate from Lao production. Vegetables commonly imported include varieties that are difficult to produce during the rainy season. In June 2002, at the beginning of the rainy season, imports accounted for 22% of quantities transacted for Chinese kale, round tomatoes and cucumbers; 15% for olive tomatoes; 2% for big Chinese mustard. On the whole for the 9 vegetables, imports account for only 8% of total quantities transacted. 80% of leafy-vegetables originate from less than 30 kilometres from the city centre. Hatsayphong is the main supplier of tomato and leafy vegetables, while Saixetha is the main supplier of cucumbers. The overall number of active traders decreases from June to September, concurrent with the influx of imported products.

Despite the short distance from farm to market, the marketing chains are characterised by a certain complexity. More than half the traders fulfil concurrently the different functions of collection/wholesale/retail. The typical chain involves farmers, collectors, wholesalers and retailers. More than 65% of quantities traded involve more than one middleman between farmers and retailers, even for a perishable vegetable like water convolvulus. The specialisation of wholesale and retail functions is more frequent for imported tomatoes than for local tomatoes. The frequent overlapping of functions may be explained by the absence of a specific location for wholesale marketing in or

around retail marketing areas and also by the small volumes transacted (less than 200kg/day for wholesalers and retailers) The 'jumbo' (tuk-tuk) is the dominant mode of transport.

Suppliers and buyers have regular relationships and occasional relationships with variable suppliers. Profit margins are quite small (10-40%). The market can be considered as competitive, yet the characteristics of the marketing chains and the market places make access to market information quite difficult.

Vegetables varieties that are difficult to produce during the rainy season in Laos compete with imports. The research found that at least some Chinese kale, round tomatoes and olive tomatoes, big Chinese mustard and cucumbers are imported. Pakchoy (or choysum), small Chinese mustard, lettuce, yard-long beans and cherry tomatoes are exclusively from Lao producers. In the beginning of the rainy season, imports accounted for 22% of Chinese kale, round tomatoes and cucumbers, 15% for olive tomatoes and 2% for big Chinese mustard. On the whole, when considering the nine vegetables studied, imports represent only 8% of the total.

When comparing Lao and Thai products, traders indicate the following advantages for local products: taste, alleged reputation for food safety; and for imported products: availability and appearance. Prices are similar or slightly lower for local products (2-12%).

These results show that the development of local production in the rainy season is a major strategy to produce additional income opportunities for farmers and traders, and decrease consumer prices. This implies the need to train farmers in terms of pesticide and variety use, as well as in new technologies for off-season production (including tomato grafting).

The comparative advantage of Thailand for producing in the rainy season has to be assessed by further research. Further research could also assist in developing ways of promoting the vegetable safety of Lao products if they are confirmed as better than Thai vegetables.

2.19 Negotiation Tools for the Commodity Chain in Vientiane

Author(s): Jean François Lecoq (CIRAD)
Date: April 2003
Pages: 23
Published on website: Y
Published on hard copy: Y

As a first step to initiate a dialogue among stakeholders in the vegetable commodity chain, a meeting with stakeholders in the vegetables sector was prepared in early December 2002 with the Department of Agriculture of the Lao Ministry of Agriculture. This meeting aimed at informing local stakeholders of some preliminary findings from the production and market surveys carried out by the project (component 1 and 2) and identifying with participatory methods market opportunities and issues for vegetable sectors development in Vientiane peri-urban area.

The report gives an overview of the vegetable sector of Vientiane province in terms of production and marketing based on the analysis of the data collected by the production and market surveys of SUSPER project. The results of the meeting held in Vientiane in early December 2002 are presented. Seasonal adaptation of the production to the market demand and reduction of price instability appeared as major issues for the development of peri-urban agriculture and especially vegetable production. Details were given on crops and months of the year where production should be developed. Some recommendations for further steps are given in the conclusion.

Component 3

Technical Innovations

Note: In the initial project organisation, Component 3 included both technical and institutional innovations. In the actual conduct of the project, most of institutional innovations were carried out in relation with Component 2 activities on market development, i.e., setting of market information and consultation systems, support to farmers' organisations for joint marketing, labelling and certification.

Section 1
Vegetable Production Systems
Reports 3.1.1 – 3.1.6

Sustainable Development of Peri-urban Agriculture in Southeast Asia: Evaluation of Technologies for Improving Year-round Production of Safe Vegetables[75]

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Taiwan

Abstract

One of the major objectives in the development of peri-urban agriculture in Southeast Asia is to enhance food security by increasing year-round supplies of safe and nutritious vegetables for rapidly growing urban population. AVRDC-The World Vegetable Center in collaboration with CIRAD, the French MOFA and the national agricultural research systems of Cambodia, Lao PDR and Vietnam initiated the SUSPER Project in 2002 to introduce and evaluate potential technologies for increasing year-round safe vegetable production. Such technologies include year-round vegetable growing under rain shelters, grafting, and low net tunnel for production of safe leafy vegetables. On-station and on-farm trials conducted over three years (2002-2005) growing season indicated increased yields of most vegetables grown under shelter than open field. However, the risk of damage on shelters is high during wet season when incidence of typhoons is frequent leading to low yield or total crop loss. Grafting of tomato onto eggplant rootstocks improved plant survival (90-100%) to flooding and increased tolerance to bacterial wilt leading to better yields (50-100%) compared to non-grafted tomato plants. The agronomic and economic benefits of grafted tomato were realized during the hot-wet production season when market price of tomato is more favourable and profitable than rice. In all sites, the use of low net tunnel was successful in producing safe leafy vegetables. Leafy vegetables such as pakchoi, Chinese kale, choysum and green mustard grown under tunnel had less damage due to heavy rain and insect pests compared to crops grown in open field. This resulted in reduced number of insecticide spray, better quality and higher marketable yield. Among the three technologies introduced and evaluated by farmers, tomato grafting will likely result in greater impact as indicated by increased adoption.

INTRODUCTION

The world urban population is expected to rise to 5.34 billion in 2025 and more than half of the population will reside in Asian cities (UNFPA, 1996). Unemployment, mounting urban wastes and the need for reliable food supply are major challenges in urban and peri-urban agriculture (Ali and Porciuncula, 2001). In peri-urban agriculture fruits and vegetables account for the major share of pesticide market (Weinberger and Lumpkin, 2005). This creates a global concern on food safety, health and environmental quality. Pesticide residues in crops especially grown in urban and peri-urban communities are attributed to failure of farmers to restrain application before harvesting. The problem is exacerbated when farmers use prohibited pesticides. Heavy metal contamination is also becoming a serious problem in urban and peri-urban agriculture. Good agricultural practices (GAP) have been developed for production of safe vegetables (Palada et al., 2005). For the past 10 years, AVRDC-The World Vegetable Center has been working in Southeast Asia to improve production of safe vegetables in peri-urban agriculture. Technologies have been developed to sustain year-round vegetable production, reduce pesticide use and improve the quality of environment and human health. In 2002, AVRDC and CIRAD initiated the SUSPER Project (Sustainable Development of Peri-urban Agriculture) in Cambodia, Lao PDR and Vietnam. Development of technical and

[75] Slightly revised paper presented at ISHS symposium, Seoul, August 13-19, 2006 and forthcoming in Acta Horticulturae.

institutional innovations is one of the components of the project. The objectives of this component are to: 1) develop year-round vegetable production systems in peri-urban areas of the major cities; 2) reduce pesticide use and residue levels in vegetables; and 3) transfer these technologies to farmer groups. This paper discusses the results of technological innovations evaluated in the three peri-urban sites over a period of three years.

MATERIALS AND METHODS

Three technological innovations for increasing year-round production of safe and nutritious vegetables were introduced and evaluated in Phnom Penh, Cambodia, Vientiane, Lao PDR and Hanoi, Vietnam from 2002 to 2005. These technologies included tomato grafting, rain shelters and low net tunnels. All technologies were developed at AVRDC in Taiwan and have been transferred and tested over a period of more than a decade in selected countries in Southeast Asia where vegetable production is limited during off seasons (AVRDC, 1995; Black et al., 2002; Black et al., 2003; Burleigh et al., 2005; Midmore et al., 1993; Palada et al., 2003; Palada and Wu, 2006; Talekar et al., 2003; de Bon, 2003). In each site, technologies were evaluated using adaptive research methods through on-station trials and farmer participatory research. Initial trials were conducted in the form of non-replicated demonstration plots. On-station replicated trials were conducted during the second and third year of the project followed by technology transfer through on-farm farmer participatory trials. Implementation and management of the field trials were organized and coordinated by the collaborating national research institutes: 1) Department of Agronomy and Land Improvement (DAALI), Ministry of Agriculture, Forestry and Fisheries in Phnom Penh, Cambodia; 2) Ministry of Agriculture and Forestry, Vientiane, Lao PDR; and 3) Research Institute for Fruits and Vegetables (RIFAV), Hanoi, Vietnam.

Technology 1 – Off-season Tomato Production using Grafted Seedlings

Tomato grafting technology was developed by AVRDC to improve and increase tomato production during the hot wet season (AVRDC, 1995). Grafting tomato onto resistant eggplant or tomato rootstocks provides protection against flooding and soil-borne diseases such as bacterial wilt common during hot-wet season. This technology was introduced to SUSPER project sites.

In Hanoi, Vietnam, trials were conducted on-station and on farms with farmers' participation. The trials at RIFAV in 2002-2004 consisted of tomato varieties (scions) TN001, TN005, TLCV15, VL2000, CHT501 and HS902 grafted onto eggplant EG203, tomato HW7996 and Doctor K rootstocks. In 2004-2005, the grafting technology was transferred to 16 farmers in Dong Anh district near Hanoi. Tomato scion varieties used were TN001, TN005, HS2922, VL2500 and BM136. All varieties were grafted onto eggplant EG203 rootstocks. Farmer cooperators attended training workshop on grafting technology conducted by RIFAV before establishing their on-farm trials.

In Phnom Penh, Cambodia, on-station trials were conducted in 2003-2004 using the facility of Research and Agricultural Development Center at Dey Eth. Tomato varieties used as scions were CLN1426A, TMTKK1, CHT501 and CLN2026D in 2003. These were grafted onto EG203 and HW7996 rootstocks. Similar varieties were used in 2004. In 2005, 15 farmers were trained on tomato grafting technology and the same farmers conducted on-farm trials on grafted tomato during the hot-wet season using four varieties (TLCV15, CHT501, TMTKK, and Mongial). All varieties were grafted onto eggplant EG203 rootstock. In Vientiane, Lao PDR only one trial was conducted at the Crop Multiplication Center (CMC) in 2003. Four tomato varieties used as scions (SR382, CHT501, CLN2026D and SIDA) were grafted onto eggplant EG203 rootstock and tomato HW7996 rootstock.

The on-station trials were conducted under shelters and open field for comparison while all farmer-managed trials were conducted in open field. Farmers followed the recommended cultural practices for tomato production including fertilizer application, furrow irrigation, insect and disease control and staking as suggested by AVRDC.

Technology 2 – Year-round Vegetable Production under Rain Shelters

Rain shelters are simple plastic houses that are built using iron pipes, bamboo or wooden frames. During the off-season when the frequency of rainfall is high, vegetable production is possible under rain shelters. Simple plastic rain shelters for year-round vegetable production were introduced and evaluated in SUSPER project sites. At RIFAV, Hanoi, trials were conducted in 2002-2004 evaluating performance of various vegetables including cucumber, yard-long bean, sweet pepper, mini-cabbage, broccoli, cauliflower, lettuce, squash, sweet pea, mustard, bush bean, pakchoi, Chinese kale, spinach and bitter gourd. Vegetables were grown under rain shelters and open field. Similar trials were conducted in Dey Eth Station, Phnom Penh, using cauliflower, French beans, yard-long bean, cucumber, bitter gourd and melon. Performance of vegetables was evaluated under rain shelters with and without side netting versus open field.

Technology 3 – Safe Vegetable Production under Low Net Tunnel

Growing vegetables under low net tunnel protects the crop from the impact of heavy rainfall during the hot wet season as well as provides a barrier against insect pests, thereby reducing pesticide spray. On-station and on-farm trials were conducted in Hanoi and Phnom Penh to evaluate the benefits of low net tunnels for producing safe leafy vegetables. In Hanoi, trials were conducted at RIFAV in 2002 and then the technology was transferred to farmers in 2004-2005. Leafy vegetables including amaranth, choysum, pakchoi, Chinese kale, lettuce and mustard green were grown in net tunnel with and without insect spray. These treatments were compared with the same vegetables grown in open field with and without insect spray. Similar trials were conducted in Phnom Penh using leafy vegetables such as water convolvulus, mustard green, non-heading Chinese cabbage, pakchoi, spring onion, Chinese kale and cauliflower. The initial trial in RIFAV, Hanoi determined pesticide residue from vegetables grown in net tunnel and open field. In all trials, data were collected on marketable yield. Insect population was monitored in some trials. Simple cost and returns analysis was performed to compare the economic benefits of producing leafy vegetables under low net tunnels.

RESULTS AND DISCUSSION

Technology 1 – Off-season Tomato Production using Grafted Seedlings
Vietnam

On-station trial in Hanoi, Vietnam showed that all non-grafted plants did not survive as a result of flooding due to heavy rainfall from a typhoon that came on 20-23 July 2004. Even plants under shelter all wilted and died after flooding. A high percentage of grafted plants survived flooding under shelter and open field except for TLCV15 grafted onto tomato rootstock Doctor K where all plants died due to flooding. All varieties grafted onto eggplant rootstock have high tolerance and survival rate. Fruit yield was generally higher under shelter than open field (Table 1). Among the varieties, TLCV15 produced higher yield than TN001 and TN005 under shelter. Marketable fruit yield was 13.04 t/ha when grafted onto eggplant rootstock and 12.07 t/ha with tomato rootstock compared to average yield of about 8.0-9.0 t/ha for TN001 and TN005 regardless of rootstock (Table 1). TLCV15 was resistant to tomato leaf curl virus (ToLCV) disease, whereas TN001 and TN005 were susceptible. Results from 16 farmer-managed trials conducted in July to October 2005 showed that non-grafted tomatoes were all infected and damaged by BW disease (Mai and Hien, 2006). All varieties were highly susceptible with 90-100% infection resulting in zero yields. In contrast, grafted plants showed high tolerance to BW disease and survived. TN005 produced the highest marketable yield both with hormone spray (33.2 t/ha) and no spray (9.5 t/ha) as shown in Table 2. VL2500 and HS2922 followed TN005 with yields of 32.3 and 32.1 t/ha, respectively, with hormone spray; and 7.5 and 7.3 t/ha, respectively, with no spray. TN001 produced the lowest yield (28.2 and 6.9 t/ha). All

harvested fruits of TN005 and TN001 were counted as marketable, but some fruits of VL2500 and HS2922 were not marketable. Symptoms of ToLCV transmitted by whitefly were also observed in all varieties, but TN005 and TN001 had lesser infection than VL2500 and HS2992. The latter varieties were also susceptible to blossom end rot (Mai and Hien, 2006).

Table 1- Marketable yield of grafted and non-grafted tomato under shelter and in open field grown during hot-wet season, 2004 in RIFAV, Hanoi, Vietnam

		Marketable yield (t/ha)			
		Shelter		Open field	
Scion	Rootstock	Grafted	Non-grafted	Grafted	Non-grafted
TN001	EG203	8.37 a[1]	0	0.66 b	0
	Doctor K	7.37 B	0	0.49 a	0
TN005	EG203	9.96 B	0	0.41 a	0
	Doctor K	9.24 B	0	0.52 ab	0
TLCV15	EG203	13.04 D	0	1.23 c	0
	Doctor K	12.07 C	0	0.44 a	0
	Mean	10.00	0	0.83	0
	CV (%)	4.90		12.1	

[1]Mean separation in columns by Duncan's multiple range test, *P=0.05.*

Table 2- Marketable yield of grafted tomato with and without hormone spray in on-farm trials, Hanoi, Vietnam, dry season, 2004.

Variety[1]	Hormone spray (yield, t/ha)	No hormone spray (yield, t/ha)
TN 001	33.2	9.5
TN 005	28.2	6.9
HS 2922	32.1	7.3
VL 2500	32.3	7.5
Mean	31.5	7.8

[1]Data are means of 16 farms.

Results of on-farm trials conducted by farmers in 2005 indicated that most non-grafted plants regardless of the variety did not survive due to flooding and bacterial wilt disease (Mai and Hien, 2006). Four farmers who planted non-grafted tomato obtained low plant survival rate (30-40%) and very low yields averaging 3.3 t/ha (Table 3). Plant survival of grafted tomato ranged from 56-100% for TN 005 and 61-100% for HS 902. Of the eight farmers who planted TN 005 the highest yield obtained was 19.8 t/ha. The lowest yield (1.5 t/ha) was obtained by one farmer who did not provide good management practice. The highest yield for HS 902 was 34.2 t/ha. Two farmers obtained yields that were below 10 t/ha. Overall the average yield of TN 005 was slightly lower (14.5 t/ha) than HS 902 (17.3/ha). Only one farmer planted grafted BM 036 with 94% plant survival and marketable yield of 30.8 t/ha. The most common disease observed on grafted tomato was the tomato leaf mold (*Fulvia fulva*) disease and seriously infected about 42% of the farms. Despite of disease incidence yield of grafted tomato was higher than non-grafted tomato (Mai and Hien, 2006).

Table 3- Plant survival and marketable yield of grafted and non-grafted tomato in on-farm trials, Hanoi, Vietnam, 2005

Variety[1]	Plant survival (%)		Marketable yield (t/ha)	
	Grafted	Non-grafted	Grafted	Non-grafted
TN 005	85	-	14.5	-
HS 902	87	33	17.3	3.4
BM 136	95	40	30.8	3.3
Mean	89	37	20.9	3.4

[1]Data are means of 16 farms.

Cambodia

In Phnom Penh, Cambodia the benefits of grafting and rain shelter were not realized because there was no incidence of heavy rainfall and flooding. In most cases differences in marketable yield between grafted and non-grafted tomato were small and not significant (Table 4). In fact, in some cases non-grafted tomato produced higher yield than grafted plants regardless of variety. The advantage of eggplant rootstock over tomato rootstock was not exhibited because yields were generally lower in plants with eggplant rootstock than tomato rootstock. Yields under rain shelter without side netting were generally higher than shelter with side netting and open field. Results from on-farm trials conducted by farmers in 2005 indicated small differences in marketable yield between grafted and non-grafted tomato. Plant survival for both grafted and non-grafted tomatoes was high which could explain the small differences in yield. Most of the crops were harvested before the incidence of flood, after which almost all crops were destroyed. The results from both on-station and on-farm trials clearly indicate that grafting technology has no agronomic and economic benefits when adverse climatic conditions (heavy rainfall and flooding) are absent as experienced in Cambodia during the tests.

Table 4- Effects of rootstocks, scions, and shelter on marketable yield of tomato grown in the hot-wet season, 2004. Phnom Penh, Cambodia

		Marketable yield (t/ha)		
Scion	Rootstock	Open field	Shelter	Shelter + net
CLN1462	EG203	16.7	28.4	6.0
	H7996	19.0	35.8	14.1
	Non-grafted	28.9	43.4	12.1
	F-test	**	**	**
CHT501	EG203	22.1	23.6	7.8
	H7996	26.5	38.8	7.3
	Non-grafted	24.8	36.0	23.9
	F-test	NS	NS	**
CLN1462A	EG203	19.7	22.0	13.9
	H7996	26.4	31.9	7.8
	Non-grafted	26.3	29.3	10.9
	F-test	NS	NS	NS
TMTKK1	EG203	26.4	28.1	41.6
	H7996	27.9	34.2	38.1
	Non-grafted	26.1	41.5	34.9
	F-test	NS	**	NS

F-test: **Significant at $P \leq 0.01$; NS=not significant.

Lao PDR

All varieties of grafted tomatoes survived better than non-grafted plants both in shelter and open field. No plants survived in non-grafted plants of varieties CHT501 and SIDA. Plants grafted onto eggplant EG203 rootstock had higher survival rating than those grafted onto tomato HW7996 rootstock (data not shown). This also resulted in higher marketable yields of plants grafted onto eggplant rootstocks. Marketable yield varied among varieties under shelter and open field. SR382 and SIDA produced higher marketable yield under shelter than open field, whereas CHT501 and CLN2026D yielded higher in open field than in shelter. Results of this on-station trial indicate that grafted tomato plants survived and yielded better than non-grafted plants. The economic analysis was initiated but not completed.

The project activities in Vientiane have been meager. The major activity was the conduct of training the trainors and training of farmers. Transfer of tomato grafting technology has been very slow. Only 3 farmers have established on-farm trial on grafted tomatoes. One of the farmers planted 6000 grafted tomato seedlings using bulk of the seedlings raised at CMC Center. Not enough grafted seedlings were produced to provide other farmers interested in the technology and for those who participated in the training. The national collaborators conducted two training workshops. One for training the trainors (ToT) and the second training of farmers (ToF). A total of 29 participants attended the ToT course while 19 farmers attended and participated in the training workshop (ToF) for tomato grafting. These activities were quite successful.

Technology 2 – Year-round Vegetable Production under Rain Shelters

Vietnam

Results of 2002 trial showed that growth of yard-long bean was seriously affected by height of rain shelter and yield was lower than in open field. Cucumber, sweet pepper and mini-cabbage produced higher yields (data not shown) under shelter than open field (Thuy, et al., 2003). In 2003-2004 out of 13 crops grown in shelters only four crops (cauliflower, sweet pepper, squash, and broccoli) produced higher yields under shelter than open field (Table 5) (Mai and Anh, 2004). Three crops (Chinese kale, spinach and bitter gourd) produced no marketable yield. Five crops (broccoli, cauliflower, sweet pea, squash and lettuce) gave positive returns under shelter and open field. These trials showed that not all crops are benefited by rain shelters. The role of rain shelters in vegetable production during off-season needs further evaluation. Success rate was low in Hanoi when farmers evaluated rain shelters for off-season tomato production. Rain shelters did not withstand the impact of heavy rains and strong wind especially during the typhoon season. Some farmers used the rain shelter as shade house for growing ornamental crops (chrysanthemums) where economic return is much higher than vegetables.

Table 5- Marketable yield of vegetable crops under rain shelter and open field, Hanoi, Vietnam, 2003-2004[1]

Crop	Marketable yield (kg/ha)		Net returns (VND/ha x 1000)	
	Shelter	Open	Shelter	Open
Broccoli	12.8	10.4	171	211
Sweet pepper	15.1	8.4	-	-
Cauliflower	15.3	8.0	19	0.4
Lettuce	17.8	17.2	54	250
Squash	20.1	15.0	157	182
Sweet pea (pod)	3.7	3.6	87	302
Kailaan mustard	4.7	4.2	- 93	-82
Bush bean	8.5	8.6	-148	-34
Pakchoi	6.3	6.4	-229	-12
Chinese kale	-	-	-348	-236
Spinach	-	-	-290	-76
Bitter gourd	-	-	-347	-234

[1]Non-replicated trial

Cambodia

Overall results of trials conducted in 2003 indicated that yields of vegetables (cauliflower, French bean, yard-long bean, cucumber and melon) were higher under shelter than in open field (SUSPER Cambodia-Lao-Vietnam Report, 2004).Yield increases ranged from 25% for yard-long bean to 96% for cucumber (Table 6). Between shelters, marketable yields were higher under shelters with net than without net. The difference can be attributed to warmer environment in shelter with net than without net. In addition, nylon net provided better protection against insect pests than shelter without net. This result was confirmed in subsequent trial conducted in 2004 where marketable yields under shelter with net were greater than those under rain shelter without net and in open field. In both dry season trials, the fruit vegetable types benefited more than the leafy vegetables in terms of marketable yield.

Table 6- Plant survival and marketable yield of vegetable crops in rain shelter and open field, Phnom Penh, Cambodia, 2003[1]

Crop	Plant survival (%)			Marketable yield (t/ha)		
	RS+N[2]	RS-N[3]	Open	RS+N	RS-N	Open
Cauliflower	89	92	98	9.3	8.4	5.4
French bean	100	100	92	11.2	8.7	7.2
Yardlong bean	100	100	95	13.7	10.4	9.6
Cucumber	100	98	94	54.6	32.1	1.8
Melon	100	96	75	31.4	14.2	0

[1]Non-replicated trial
[2]RN+N = Rain shelter with net
[3]RN-N = Rain shelter without net

Technology 3 – SafeVegetable Production under Low Net Tunnel

Vietnam

In a comparative study conducted in 2002 results showed that leafy vegetables grown under low net tunnel had significantly less insect damage than those grown in open fields and sprayed with insecticides. Insecticide residues were also significantly higher in vegetables grown in open field and in low net tunnel that where sprayed with insecticides. No insecticide residues were found in vegetables grown in low net tunnel without insecticide spray (Table 7). Marketable yield increased from 4.2 t/ha and 8.7 t/ha with no net to 19.1 t/ha and 18.0 t/ha with net without pesticide spray for amaranth, respectively. Similar trend was observed for leafy vegetable choysum. This trial showed that the use of low net tunnel eliminates the need for pesticide spray in leafy vegetables (Chien et.al., 2003).

Table 7- Insecticide residue in amaranth samples as analyzed by RBPR and GC methods, Hanoi, Vietnam, 2002

Treatment	RBPR[1] (% AchE Inhibition)			GC[2] (mg/kg)
	3 DAS[3]	5 DAS	7 DAS	5 DAS
Net	18.4	18.7	16.2	Negative
IPM	35.8	27.7	16.7	0.81
Net-IPM	42.9	36.4	27.3	11.1

[1]RBPR = Rapid bioassay pesticide residue
[2]GC = Gas chromatography
[3]DAS = Days after spraying

Results of on-farm trials conducted by 8 farmers in 4 locations in 2004 showed that farmers were successful in growing leafy vegetables pakchoi and choysum under net tunnel without insecticide spray. Marketable yields were higher under low net tunnel than in open field (Table 8) (Chien, 2005). During the wet season, 8 more farmers conducted the trial by growing pakchoi and green mustard.

In all sites, low net tunnel was effective in reducing insect damage as well as impact of heavy rain. Marketable yields were consistently greater under low net tunnel than open field. Economic analysis indicated that all farm sites growing vegetables under low net tunnel had high net returns.

Table 8- Marketable yield (kg/plot) of amaranth in low net tunnel and open field with and without insect spray, Hanoi, Vietnam, 2002

Treatment	No insect spray	Insect spray	Mean	Difference
Net tunnel	11.3	11.1	11.2	0.2 ns
Open field	3.6	6.2	4.9	-2.5**
Mean	7.5	8.6	8.1	-1.2
Difference	7.7**	5.0**	6.3	

**Significant at P<0.01
ns = not significant

In 2005 hot wet season, farmer-managed trials demonstrated the effectiveness and efficiency of net cover in protecting leafy vegetables against insect pests and impact of heavy rains. Insect population and damage were lower under net cover than in open field (Chien, 2005). Marketable yields were 1.5 to 2.0 times greater under net cover than in open field resulting in higher gross and net revenues. Vegetables grown under net cover also were of high quality (no insect damage) and free of pesticide residues (Table 9). These studies clearly demonstrate that low net tunnel technology for safe vegetable production can be easily transferred and adopted by farmers in peri-urban areas of Hanoi (Chien, 2005).

Table 9- Insect damage and marketable yield of leafy vegetables under low net tunnel and open field in on-farm trials, Hanoi, Vietnam, 2005

Crop	Number of farms	Plant damage (%)		Marketable yield (t/ha)	
		Net	Open	Net	Open
Chinese kale	1	0.5	78.5	19.7	6.9
Lettuce	1	0.5	85.7	11.1	5.0
Pakchoi	7	2.6	81.7	19.4	7.9
Indian mustard	4	2.5	79.7	20.4	8.1
Mean		1.5	81.4	17.7	7.0

Cambodia

Results of on-station trial in 2002 showed that vegetables grown in open field were damaged by insect pests even with insect spray. In contrast, less insect damage was observed in vegetables under low net tunnel resulting in higher marketable yield. Using mustard green, non-heading Chinese cabbage, and Chinese kale, trials in 2004 confirmed the advantage of using low net tunnel versus open field. Marketable yield of leafy vegetables were higher in low net tunnel than in open field. Growing vegetables under net tunnel resulted in average yield increase of one ton/ha (Table 10).

Table 10- Marketable yield of vegetables under low net tunnel and open field in on-farm trials, Phnom Penh, Cambodia, 2004[1]

Crop	Net tunnel Sterile soil	Net tunnel (no spray)	Open (+ spray)	Open (- spray)	Farmer's Practice
Chinese kale	27.5	25.4	22.0	20.5	23.5
Spring onion	24.0	29.0	22.5	23.0	23.5
Cauliflower	17.0	13.0	11.0	3.0	12.0
Pakchoi	46.0	46.5	45.5	36.5	48.0
Mean	28.6	28.5	25.3	20.8	26.8

[1]Data from 18 farmer-managed trials.

Results of farmer-managed trials conducted by Srer Khmer (Centmill, 2006, infra) showed that during the dry season, small differences in marketable yields were obtained for each crop. However, vegetables grown under net tunnels yielded slightly higher (2.0 t/ha more) than those grown in open field with spray. Yields of Chinese kale, spring onion and pakchoi were almost similar in net tunnel with no spray and with spray suggesting that with net tunnel, there is no need for insecticide spray. Cauliflower was the most susceptible crop and yield was poorly reduced in open plots with no spray (3.0 t/ha). Insect pest population was greatly reduced (80% less) in net tunnels.

In the wet season, 2005 similar results were obtained where vegetables grown under net tunnel yielded slightly better than those in open field with sprays. Mean yield differences were in the range of 2-8 t/ha. Vegetables grown in open field with no sprays produced the lowest yields. Generally, yields during the wet season were lower than in the dry season, although average insect population was low. Vegetables that were most benefited by low net tunnel in terms of reduced insect population during the wet season were Chinese kale, cauliflower and pakchoi. In fact, zero insect population was observed in pakchoi under low net tunnel in both dry and wet seasons.

Economic returns from vegetables grown under net tunnels and open field varied with species. During the dry season all vegetables (except cauliflower) grown under net tunnel gave positive net returns. However, net returns were lower than vegetables grown using IPM technique and those in open field with no spray. All vegetables except spring onion grown using farmer's practice (with spray) resulted in net negative returns. Total input cost was greater than gross revenue for most vegetables.

SUMMARY

The study has shown that in most peri-urban locations of Southeast Asia where adverse environmental conditions prevailed during the wet season, grafted tomato plants performed better than non-grafted plants in terms of tolerance to flooding, bacterial wilt disease and overall yield. Cambodia was the only site where the benefits of grafting technology were not demonstrated due to low rainfall and unusually dry weather. The combined effects of grafting and rain shelter in increasing tomato yield are significant only during season of heavy rainfall. However, the benefit from rain shelter may not be realized when seasonal rainfall is relatively low. Off-season tomato production using the grafting technology (eggplant rootstock) improved plant survival (90-100%) against flooding and increased tolerance to bacterial wilt disease leading to better yields (50-100%) compared to non-grafted tomato plants. The agronomic and economic benefits of grafted tomato were realized during the hot-wet season production when market price of tomato is most favourable and profitable than rice.

On-station and on-farm trials conducted during the project duration indicated increased yields of most vegetables grown under shelter than open field. The risk of damage on shelters is high during wet season when incidence of typhoons is frequent leading to low yield or total crop loss. Shelters can be utilized in extending production season during the dry season for selected high value crops.

In all sites, the use of low net tunnel was successful in producing safe leafy vegetables. Leafy vegetables grown under net tunnel had less damage due to heavy rains and insect pests compared to crops grown in open field, resulting in reduced insect spray, better quality and higher marketable yield. Among the three technologies introduced and evaluated by farmers, tomato grafting will likely result in greater impact as indicated by increased adoption. Wider adoption through the development of infrastructure supporting the technology will increase market supply, provide high economic returns and improve farmers' income in peri-urban agriculture.

ACKNOWLEDGMENTS

The authors are grateful to researchers and support staff who conducted the trials in Hanoi and Phnom Penh and Vientiane under the Sustainable Development of Peri-urban Agriculture in Southeast Asia (SUSPER) Project supported by the French Ministry of Foreign Affairs (FMOFA). Their contributions are highly appreciated.

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3.1.1 Off-season Tomato and Year-round Vegetable Production under Shelter in Hanoi

Author(s): Le Thi Thuy, Vu Thi Tinh, Dang Hiep Hoa, Ngo Thi Hanh, Nguyen Kim Chien, Vu Thi Hien, Nguyen Duy Hung
Date: April 2003
Pages: 51
Published on website: Y
Published on hard copy: Y

The experiment to test tomatoes grown under shelter during the hot wet season in Hanoi was conducted at the RIFAV experimental field, Hanoi, from May 5 to October 3, 2002. Three AVRDC varieties and some local varieties were grafted onto EG203 eggplant and HW7996 tomato rootstock to evaluate different grafting combinations in order to make some recommendations for farmers.

There was a highly significant difference in marketable yield and development of grafted tomatoes that were sheltered and non-sheltered, however grafted tomatoes using the EG203 eggplant displayed no significant differences in the productivity vis-à-vis sheltered or non-sheltered. Therefore, the eggplant rootstock is obviously suitable for grafting off-season tomato in the hot wet season (summer) in Vietnam. EG203 rootstock helps survival of off-season tomatoes from sunshine in the open-air field. Further more, the appearance of bacterial wilt of tomatoes was not seen in this experiment. Species HS 902 and CHT 501 are obviously appropriate to the function of scions for tomatoes planted in the hot wet season (summer) of Vietnam. This grafting technique is earmarked for dissemination to some districts of Hanoi such as Dong Anh, Gia Lam and Thanh Tri.

Experiments on crop diversification under shelter during the hot wet season were conducted at the RIFAV experimental field in the Red River Delta in the north of Vietnam. The trial sought to evaluate four vegetable crops grown under a rainproof shelter; cucumber, yard-long bean, sweet pepper and mini-cabbage from June to October 2002. Results of the experiment have indicated that in the wet season, the growth of yard-long bean was seriously affected by the limiting height of the rainproof shelters. Therefore, the yield of yard-long bean grown under shelters is lower than that in the open-air field. However, under the rainproof shelter, cucumbers, sweet peppers and mini-cabbages brought high yields with a greater number of fruits (cucumber), higher weight (sweet pepper) and larger size (mini-cabbage).

Experiments were conducted in the use of technology to develop safe vegetable harvesting. Tunnel net treatment yielded significantly fewer damaged plants in comparison with open-air field treatment across insecticide. Amaranth and choy sum have been completely protected from key-pests by the use of the tunnel net. The tunnel net technology cut the rate of loss due to pests so markedly that the use of pesticides was unnecessary and therefore no dangerous residues were left on produce.

3.1.2 Rapid Assessment of Rain Shelter Technology Transferred to Farmers in Four Project Sites in Hanoi during the Hot Wet Season of 2003

Author(s): Boun-Tieng LY
Date: June 2004
Pages: 18
Published on website: Y
Published on hard copy: Y

After one year, 15 out of 16 rain shelters (94%) given to farmers are unusable and most of farmers gave up the proposed innovative technology: hot wet season grafted tomato combined with a rain shelter. Three main factors explain this high rate of failure: (1) Lack of care because most farmers are not convinced of its usefulness and economic profitability. (2) The proposed roof is not adapted to the natural conditions of the Red River Delta, where frequent storms blow unimpeded, tearing the plastic film roof at its weakest point, the sewed joints. (3) The low quality of locally produced plastic film that cannot resist UV for a long period. In addition, the transferred technology is very expensive in terms of (1) cash flow (3 to 60 times higher than the total input costs of some other crops) and (2) fixed assets (a rain shelter of 150m² costs about $150 or more than 6 months of an agricultural labourer's income). These high costs translate to high risks, as only 18 % of farmers made a profit. However, one farmer adopted the proposed combined innovative technology, (he obtained an exceptional yield last season, equivalent to a very good main season crop). We should monitor his success in the next off-season using the grafted tomato during the rainy season of 2004. Considering the high risk of broken roof (94% in one year), the cost of plastic film (40% of the rain shelter total cost), the high input costs required and the limited success in trials (only 18%), it is easy to understand the farmers' reluctance to adopt this combined innovative technology.

However, two farmers adopted only the rain shelter. They used it to produce separate crops that the SUSPER project did not test, such as flowers and celery. They made a much higher profit than the estimated net would have been from using the proposed integrated technology. The ratio of net income/cropping duration for celery is 3.7 times higher than the best yield expectation for grafted tomato. Thus, the SUSPER project should diversify to other high value crops. A list of such high-income crops should have been established at the beginning of the project by analysing the production system in the peri-urban area.

Some farmers can see the high potential of grafted tomato to produce in the hot wet season: they want to try for earlier production in open field. With such good initiative, the SUSPER project agreed to support their initiative in future studies.

For the next hot season, the focus should be on: Farm trials with early production of grafted tomato in open field (emphasis on the economic evaluation of the trials). A close follow-up of farmers who are still using the rain shelters in order to have deeper analysis of their reasons. The on-going research should also evaluate the possibility and the cost of a rain shelter with only one plastic film sheet. Another line of study could involve making an inventory of effective high economic value crops in order to diversify the stock list of crops to be tested under the rain shelter (in case a stronger model of roof is found and a second phase of the SUSPER project is initiated).

3.1.3 Economic Analysis of Grafted Tomato Trials in Dong Anh, Hanoi in 2004

Author(s): Nguyen Thi Kim Anh, Boun-tieng Ly
Date: May 2005
Pages: 22
Published on website: N
Published on hard copy: N

The report is based on in-depth economic data collected on 15 farmers of Le Phap Village, Tien Duong commune, Dong Anh district, who cultivated grafted tomato (transplanted in August 2004, and harvested between December 2004 and February 2005).

During our interviews, most farmers participating in the grafted tomato trial said that they had a successful tomato crop. The marketable yields are not so different from farmer to farmer, 1-1.6 ton/sao, (an exceptional case was 2.6 tons/sao i.e. 7.2 tons/ha as 1 sao = 360 m²). The good price period lies in October, November and at the end of April. Those who missed this price window had lower net income. The variation of incomes is also explained by variations of input use. The highest revenue was offset by the fact that for she had to invest a lot in the input while other farmers invested less yet had higher profits (more than 200%)

Average grafted tomato margins are higher than 4 out of 5 of alternative crops. Grafted tomato crops generated relatively good daily earnings making the working day quite rewarding with 87% of farmers gaining between 20,000 and 47,000VND per day. The average earnings are higher than most other agriculture-related jobs such as ploughing, weeding, bed building and rice plucking. Furthermore, these jobs are seasonal whilst cultivating grafted tomato gives farmers a frequent and stable income for a long period.

The input costs of grafted tomatoes are high (181,000 VND/month per sao). Most of these costs go to seedlings, pesticides and fertilizers. If farmers can do grafting work themselves, these costs may be reduced. Furthermore, as shown above, high input costs do not mean a good rate of return. The two best profit rates had lower than average input costs (140,000 – 160,000 VND/month per sao).

In conclusion, SUSPER targets can be met technically due to the grafted tomatoes resistance to flooding, heat and soil-borne diseases. Grafted tomatoes generate a higher net income, a more economically rewarding workday and a higher rate of return than most other crops. Results would even better if they were grown and harvested earlier, in the good price period (June to September).

3.1.4 Transfer of Tomato Grafting Technology to Private Sector in Hanoi (Hanoi Seeds Company)

Author(s): Viet Thi Tuat (Hanoi Seed Company)
Date: Oct 2005
Pages: 9
Published on website: Y
Published on hard copy: N

This experiment resulted in the transfer of technology with success rates of an average of 93.3% for four tomatoes varieties. Although this was the initial attempt, HSC considers that company technicians mastered grafting tomato onto eggplant rootstock as instructed by the SUSPER project.

The grafted seedlings were transferred to twenty-one pilot farmers in six communes around Hanoi, one safe vegetable production company in peri-urban of Hanoi and five workers at HSC. In total 23,500 seedlings were transplanted on 0.78 ha all over Hanoi peri-urban areas.

The main objectives of this season were to increase the farmers' awareness of the advantages of grafted tomato and disseminate the seedlings to as wide a network as possible. Economic results may not be discernable for this first season. However, the SUSPER project supported the decision financially and technically to disseminate the technology.

HSC will continue to produce grafted tomato seedlings for farmers, especially farmers in the safe vegetable program in Hanoi and neighbouring provinces in the coming season, with a stronger focus on making a profit.

3.1.5 Technology Transfer of Off-season Tomato Production in Hanoi

Author(s): Nguyen Trong Mai, Nguyen Thi Thu Hien (RIFAV)
Date: January 2006
Pages: 11
Published on website: Y
Published on hard copy: N

The effect of grafting on yield and disease resistance of tomato varieties was evaluated by monitoring 19 farmers (15 growing grafted tomato, 4 growing non grafted tomato) of Le Phap Cooperative in Tien Duong commune, Dong Anh district near Hanoi during the off-season (hot wet season) production period (August to December 2005). Varieties evaluated were TN 005 (Trang Nong Seed Co.), HS 905 and BM 136 (Seminis Seed Co.). All varieties were F_1 hybrids. Results indicated that most non-grafted plants regardless of the variety did not survive due to flooding and bacterial wilt disease. Four farmers who planted non-grafted tomato obtained low plant survival rate (30-40%) and very low yields (1.9-6.1 t/ha), 3.3 t/ha on average. Plant survival of grafted tomato ranged from 56-100% for TN 005 and 61-100% for HS 905. Of the eight farmers who planted TN 005 the highest yield obtained was 19.8 t/ha. The lowest yield (1.5 t/ha) was obtained by one farmer who did not provide good management practice. The highest yield for HS 905 was 34.2 t/ha. Two farmers obtained yields that were below 10 t/ha. Overall the average yield of TN 005 (monitored for 8 farmers) was slightly lower (14.5 t/ha) than HS 905 (17.3/ha) (monitored for 10 farmers). Only one farmer planted grafted BM 136 with 94% plant survival and marketable yield of 30.8 t/ha. The most common disease observed on grafted tomato was the tomato leaf mould (*Fulvia fulva*) disease and seriously infected about 42% of the farms. Despite the disease incidence yield of grafted tomato was higher than non-grafted tomato.

3.1.6 An Economic Analysis of Grafted Tomato Production in Hanoi

Author(s): Mrs To Thi Thu Ha, FAVRI
Date: 2006
Pages: 10
Published on website: N
Published on hard copy: N

The advanced technology of grafted tomato have been introduced and well adapted in Vietnam since 2001. To assess the economic impact of this technique on farmers, a study was conducted in peri-urban areas around Hanoi in 2005. A total of 31 farmers were interviewed in Tien Duong commune (Dong Anh district), including twenty experimenting grafted tomato. The results show that grafted tomato needs more investment on inputs such as seeds and fertilizers than non grafted tomato. However, the yield, and net return of grafted tomato is significant higher, by 32%, and 300%, respectively than non-grafted tomato. Grafted tomato is suitable for off-season production when high farmer income can be obtained.

3.1.7 An Analysis of Economic and Environmental Impact of Safe Leafy Vegetable Production in Hanoi

Author(s): To Thi Thu Ha and Mubarik Ali
Date: 2006
Pages: 29
Published on website: N
Published on hard copy: N

This study aims at evaluating economic and environmental impact of leafy vegetables with different technologies. Surveys on inputs and outputs were done in 2005 in four peri-urban districts in and around Hanoi on a total of 59 farmers including 33 classified as farmers with shelters, 18 without shelters and low pesticide use, 8 with shelters and high pesticide use. Besides, a total of 28 samples of products, 28 samples of soil and twelve samples of water were collected and analysed to assess contents of pesticides, nitrates, heavy metal and micro-organisms and compare the three groups.

Soil and water conditions in these areas are suitable for crop growing. Farmers using shelters to produce vegetables obtained the highest yields and economic incomes, followed by the group without shelters and low pesticide applied. Farmers generally have good knowledge and management of crop production and environment. However, some farmers still use excess inputs that cause pollutions and losses in economic benefits.

3.1.8 Low Tunnel Net Technology Development in Kandal province 2005

Author(s): Meach Centmill (Srer Khmer)
Date: Feb 2006
Pages: 26
Published on website: N
Published on hard copy: N

Tests on low tunnel net technology were done on the fields of 18 farmers, in Kien Svay and Saang districts, at two times of 2005 (wet season and dry season). Agronomic and economic data were collected for four crops (Chinese kale, spring onion, cauliflower, pakchoi). Agronomic data included size of plants, yield and number of insects. Comparisons were done on covered crops (sterile or non-sterile), and non-covered crops (with IPM, with farmers' practice, without spray).

The results showed that yields were always higher when using crops covered with low tunnels. Economic data show that farmers lose money with their current practices, except for spring onion in the dry season. Incomes are positive with low tunnel nets in the case of pakchoi and spring onion. Interestingly, the highest incomes were obtained without cover and without any spraying for all crops except for pakchoi in the wet season where the cover enabled higher benefits, and except for cauliflower in the dry season where farmers lose income in all situations.

A field trip was organised in Dei Eth (Kien Svay district) in January 2006 with 57 farmers to present these results and the economic, health and environmental advantages of limiting pesticide spraying.

Section 2
Aquaculture production:
Reports 3.2.1 – 3.2.3

3.2.1 Overview of Aquaculture Systems in Peri-urban Areas in Phnom Penh

Author(s): Le Thanh Hung, Nguyen Thi Thanh Truc
Date: June 2004
Pages: 30
Published on website: N
Published on hard copy: N

The aquaculture production system in peri-urban area of Phnom Penh is quite intensive. It supplies high-quality fish for restaurants and high-income inhabitants in Phnom Penh. It is worth noting that the intensive producers probably contribute not less than two thirds of all edible fish from peri-urban Phnom Penh. In order to ensure their productive role and the continued supply of freshwater cultured fish, the authorities should facilitate input channels: principally fingerlings and artificial feed.

Fingerling supply of Clarias hybrid and Pangasius with their dependency on nature and artificial seed from Vietnam is not enough. For sustainable development, hatcheries need to be established. These facilities had been built previously in provinces and managed unsuccessfully by the government. Therefore, it is suggested that training fish farmers how to set up and manage hatcheries and to breed the brood fish is essential for further development. Existing hatcheries in provinces can serve as training centres for practicing induced spawning of Pangasius, hybrid Clarias and other future developments.

It is also important to reduce the dependence of farmers on rubbish or sewage as a nutrient source during peak season. Farmers usually make their floating feed at home. Floating feed produced by feed mills is commonly used in Thailand and Vietnam and has begun to replace sewage/rubbish feed but has not been seen in Cambodia yet. Training farmers how to use alternative ingredients such as soybean meal and other protein sources to prepare homemade feed for Pangasius and Clarias is an essential task for further development. Floating feed produced by feed mills requires a high investment to buy a feed extruder and demand is not sufficient yet to support the purchase.

Fish marketing channels in peri-urban Phnom Penh are quite efficient at supplying fresh fish to consumers not only in Phnom Penh but in other provinces as well. The market price in Phnom Penh reflects supply and demand and can regulate exports and imports to/from Vietnam and Thailand.

Several options can be exploited to further development of aquaculture. Foremost among these are study tours for fish farmers and officers to Vietnam and using trainers from Vietnam. These may be most useful in terms of savings of money and efficiency.

3.2.2 Impact Assessment of the Net Cages Transferred to Farmers in HCM City

Author(s): Le Thanh Hung, Tran Van Minh, Bui Thi Phuong Thao, Nguyen Thi Thanh Truc, Bountieng Ly
Date: Oct 2004
Pages: 14
Published on website:
Published on hard copy: Y

Red tilapia was first introduced to Vietnam in the 1990's. It took more than a decade to become a common table item. Now red tilapia has become an important banquet dish for city consumers, in particular in Ho Chi Minh City. After a limited expansion at the beginning due to production constraints, red tilapia produced in Ho Chi Minh City developed exponentially, with a 717-percent annual growth between 2002-2005, thanks to the introduction in 2002 of an innovative technique, the nylon net cage, supported by the French-funded research project named SUSPER.

In Ho Chi Minh City peri-urban areas, after introduction of the innovative tool, red tilapia culture switched from open pond to cage rearing, in particular the nylon net cages. In 2005, red tilapia produced in cages in Ho Chi Minh City peri-urban area totalled 13,500 metric tons, covering fully the demand of this megalopolis, estimated at 33-35 tons/day. The breakdown of this production is as follows: 4 percent is produced using stainless steel cages, 42 percent using traditional wooden cages and 54 percent using nylon net cages. Thus, this new technology has become the dominant structure of cage growing for red tilapia. Indeed, wooden cages are too expensive due to the scarcity of wood, while the nylon net cage, 4.3 times cheaper, makes red tilapia growing accessible to many less wealthy farmers. They have adopted this tool because it is inexpensive, technically efficient and economically profitable with low investment risk. Indeed in 2005, Ho Chi Minh City cage farmers created 1,964,000 $ of added value, where 61 percent of the value is accounted for by use of nylon net cages, covering almost the whole SUSPER project budget. Furthermore, this innovative technique seems to be sustainable, as it is spreading on its own to the Mekong Delta. However, this undeniable fast-track success raises farmers' concerns about overproduction and is causing local authorities to fear environmental pollution.

3.2.3 Dissemination of Aquaculture Technology in Peri-urban Phnom Penh of Cambodia

Author(s): Chin Da
Date: Dec 2005
Pages: 13
Published on website: N
Published on hard copy: N

Some of the existing fish cage farmers are interested in the advantages of the nylon net fish cage. Primarily of interest are the low cost construction and effectiveness of growing fish. However, the majority are afraid the nylon net may be easy destroyed by fish predators (especially Komport fish) and unfriendly people (vandals/ thieves). Nevertheless, caged fish have grown well, but with variation depending on feed supply. During the project, some fish cage farmers who are interested in the project activities came to see and ask questions of the five project farmers.

The dissemination activities of the project staff and the five farmers using the technology have aroused the interest of the Mekong Fish Conservation project of MRC. They have asked for duplicate cages for the MFC project. Also, two local fish farmers duplicated the cage by themselves. Finally, one of the project frog farmers, raising 'Hapa frogs' is interested in using the nets in his fishponds.

Another facet of the project focused on frog species, many fish farmers are interested in Hapa frogs because they grow fast and are easy to raise. Presently, there is no further planned distribution of the frog other than to the farmers mentioned above. However, following training in Vietnam on frog and Tilapia production, the project has translated the technical document into Khmer as a booklet "Frog culture and seed production". This document has garnered the interest of the Director of DOF and the Ministry of Agriculture Forestry and Fisheries. It is distributed to farmers who are trained by SUSPER project and will be distributed to other interested aquaculturists.

Fish growth is a key area of the project. Fish cage farmers were instructed to take care in recording data properly in order to meet the requirements of project and to better aid cage farmers themselves. Data collection was done every month and analyzed at the end of project. The five farmers continued to grow their fish in cages until May or June of 2006 at which point their fish would be standard market size.

The five recruited farmers have been utilizing different feed according to their facilities and their interest. This has affected growth rates. Moreover, based on observation the growth rate is also dependant on the quality of spawn and fingerlings stocked. Among the farmers, two have low quality stocks that, even with quality feed, have grown slowly. One farmer reported excellent growth using feed pellets imported from Vietnam.

Communications

Leaflets and newsletters

a. Project leaflet- May 2002
b. Project newsletter Vol.1- No. 1- July 2002
c. Project newsletter Vol.2- No. 1- June 2003
d. Project newsletter Vol.2- No. 2- August 2004
e. Project newsletter Vol.3- No. 1-August 2005

Website

http://www.avrdc.org/susper

Training materials

1. Tomato grafting

- Grafting Tomatoes for Production in the Hot-Wet Season: English - Vietnamese
- Sowing calendar: English - Vietnamese
- Grafting technique: English - Vietnamese

2. Aquaculture farming

- How to build a floating nylon net cage - Vietnamese
- Tilapia culturing techniques in pond - Vietnamese
- Red tilapia culturing techniques in floating net cage - Vietnamese
- Thai frog growing techniques - Vietnamese

Journal papers

Component 1

1. Thapa R. B., Borne F., Kusanagi M., and Pham Van Cu, 2004. Integration of RS, GIS and AHP for Hanoi Peri-Urban Agriculture Planning. Paper for Mapasia.
2. Ali M., De Bon H., and Moustier P., 2005. Promoting the Multifunctionalities of Urban and Peri-urban Agriculture in Hanoi, Urban Agriculture Magazine, No. 15, pp. 11-13.
3. De Bon H., 2003. L'agriculture périurbaine : enjeux et menaces sur l'alimentation de proximité. *In :* Marché alimentaire et développement agricole au Vietnam, *Eds* : Moustier P., Dao The Anh, Figuié M., Malica, Service de coopération culturelle de l'Ambassade de France au Vietnam, Hanoi, pp. 86-91
4. Ali M., 2007. "Peri-urban Vegetable Systems in Southeast Asia: Challenges and Opportunities". In Acta Horticulturae, In Print.

Component 2

1. Moustier P., Vagneron I. and Bui Thi Thai, 2004. Organisation et efficience des marchés de légumes approvisionnant Hanoi (Vietnam). In: Cahiers Agricultures, Jan- Feb pp. 142-147.
2. Moustier P., Figuié M., Nguyen Thi Tan Loc and Ho Thanh Son. 2005. The role of coordination in the safe and organic vegetable chains supplying Hanoi. 2006. In Acta Horticulturae, (699), pp. 297- 303
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4. Moustier P., and Danso G., 2006. Local economic development and marketing of urban produced food. In: Cities farming for the future: urban agriculture for green and productive cities, R. van Veenhuizen. Ruaf Foundation, Idrc, Iirr, 7, pp. 173-208.

Component 3

1. De Bon H., 2003. Improving techniques for peri-urban vegetable production in South-east Asia. *Urban Agriculture- Magazine*, N°10, August 2003, pp. 12-13
2. Grafting a healthier tomato in Hanoi, http://new-ag.info/07/02 (website of the New Agriculturalist).
3. Palada M., and Ali M., 2007. Sustainable Development of Peri-urban Agriculture in Southeast Asia: Evaluation of technologies for improving year-round production of safe vegetables. In Acta Horticulturae, In Print.

Preparatory reports

National workshop on "safe and year round vegetable production in peri-urban areas", 15-16 December 1999, Hanoi. Hanoi, RIFAV, CIRAD, Vietnam, 138 p (with presentations by Hubert de Bon, Tran Van Lai, Mai Thi Phuong Anh, Tran Khac Thi, Dao The Tuan, Nguyen Thi Lam, Ha Huy Khoi, Bui Quang Xuan, bui Dinh Dinh, Le Thanh Hung, Nguyen Dinh Long, Nguyen Thi Xuyen).

Planning workshop on sustainable development of peri-urban agriculture for food security in South-East Asia. 16-19 February 2000, Hanoi, RIFAV, CIRAD, Vietnam, 109 p (with presentations by P. Moustier, Nguyen Tien Dinh, Lowell Black, Kham Sanatem, Dao The Tuan, Le Thanh Hung, Tran Van Lai, Agrisud, Nuth Sakhan, Chhay Rithisen, Sornprach Thanisawanyangkura, Jacques Pagès).

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Scom: Steering committee – C: component – N coordinator: National coordinator

List of Acronyms

AVRDC	Asian Vegetable Research and Development Centre
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
DARD	Department of agriculture and rural development
DSA	Département des Systèmes Agraires
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GSO	General Statistics Office
HCMC	Ho Chi Minh City
HSC	Hanoi Seed Company
IOS	Institute of Sociology
ICARD	Information Centre for Agriculture and Rural Development
IPM	Integrated Pest Management
IPSARD	Institute on Policy and Strategy for Agriculture and Rural Development
MAF	Ministry of Agriculture and Fisheries
MAFF	Ministry of Agriculture, Forestry and Fisheries
MARD	Ministère de l'agriculture et du développement rural
NIN	National Institute of Nutrition
ONG	Organisation non gouvernementale
PNUD	Programme des Nations Unies pour le développement
RIFAV	Research Institute on Fruits and Vegetables
SM	Supermarket
SUSPER	Sustainable Peri-urban Agriculture
VAAS	Vietnam Academy of Agricultural Science
VASI	Vietnamese Agricultural Science Institute
VAT	Value added tax
VLSS	Vietnam Living Standard Survey
VND	Vietnam dong

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Project N°2002- 56 funded by Misnistry of Foreign Affairs of France, implemented by:

- Asian Vegetable Research and Development Center (AVRDC)
- Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)
- Ministry of Agriculture & Forestry, Laos PDR
- Ministry of Agriculture, Forestry & Fisheries, Kingdom of Cambodia
- Research Institute of Fruit and Vegetable (RIFAV), Vietnam
- University of Agriculture and Forestry (UAF), HCMC, Vietnam
- Markets and Agriculture Linkages for Cities in Asia